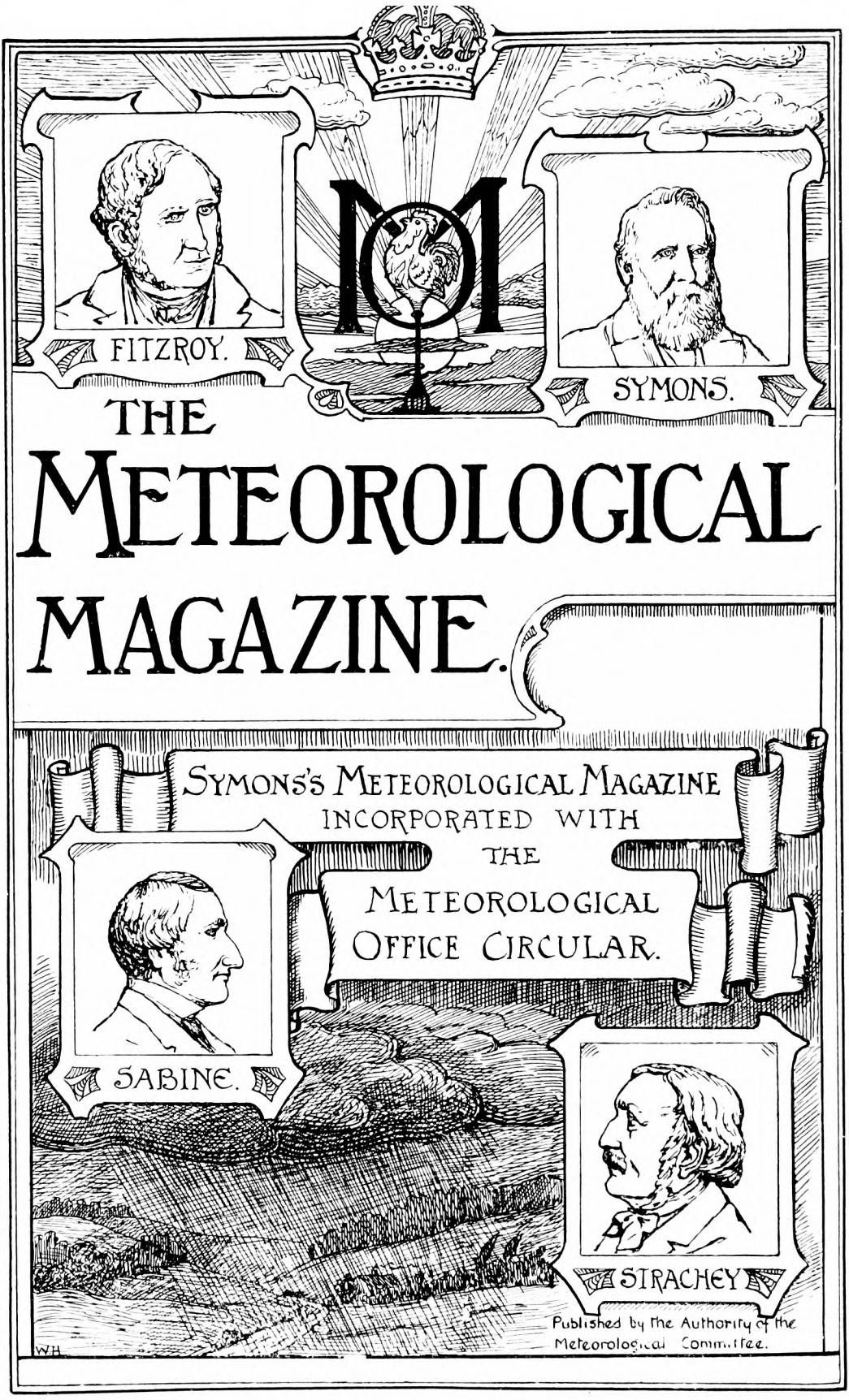

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Symons's
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WEATHER MAPS IN NEWSPAPERS.

On January 1st the *Morning Post* commenced the publication of the daily weather chart prepared by the Meteorological Office from the 6 p.m. observations. The area included extends from Iceland in the north-west to Corsica in the south-east, the British Isles having a central position and the west of continental Europe, from Scandinavia to the Pyrenees being shown. Isobars are given for intervals of 5 millibars, and the lines are numbered at one end with the pressure in millibars, at the other with the height of the mercurial barometer in inches and hundredths. As the map extends across two columns it is very clear and legible, a great advance on any previous presentation of a weather chart in a British newspaper.

In introducing the new feature the *Morning Post*, under the heading of "A fascinating daily study," started a series of meteorological articles with the happy quotation from Ruskin :—

> "While the geologist yearns for the mountain, the botanist for the field, and the mathematician for the study, the meteorologist like a spirit of a higher order than any, rejoices in the kingdom of the air."

The writer understands that a new era in public appreciation of meteorology began with the armistice, and he says : "In all educational establishments, from the Universities, through the Training Colleges, down to the elementary schools, familiarity with the daily Weather Map, and its indications, has now become an imperative necessity. Lectures based upon the many erroneous theories of pre-Weather Map days which are found in most text books, and illustrated by diagrams of a generation or half a century ago, are out of date—they are the dried-up, lifeless bones out of which there comes no sustenance. What is now required is the living thing, something that appeals to and interests the scholar because he feels that he is being taught to appreciate what he is experiencing at the moment. This living thing is the Weather Map which a very large proportion of the readers of the *Morning Post* will have served up with breakfast every morning, and in more distant regions by mid-day."

The spirit of this paragraph is that spirit of triumphant hope that "springs eternal" from the ashes of the past. It has now a better opportunity than ever before to be justified by the spread of knowledge. We welcome the enthusiasm with which the *Morning Post* has inaugurated the teaching of weather-lore to its readers. Our readers, of course, know that the value of the weather map was known and appreciated even a generation ago and this fact makes them the happier for every fresh recognition.

We were alarmed, fortunately without reason, when *The Times* failed to resume its familiar discussion of the weather; but in due course the new large-scale weather map began to appear in its columns also, though the absence of shading to distinguish land from water makes it at first sight less effective than that in the *Morning Post*. We cannot forget that it is due to the enterprise of *The Times* that weather maps first appeared in a daily paper: nay more, that it is to that journal we owe the first construction of a 6 p.m. map by the Meteorological Office. This is now an old story, but it is worth while to remember that for a time more than forty years ago, the cost of the 6 p.m. weather report was borne by a newspaper. *The Times* report before the war made a feature of a natural-scale diagram showing the hourly readings of the great glycerine barometer which was one of the peculiar glories of Printing House Square. When a rapid rise or fall of pressure occurred half a column or more was filled with this diagram and we can hardly wonder that it has been suppressed. The space is more usefully occupied by a special report on Aviation Weather.

The superior clearness and larger scale of the new weather maps respond worthily to the impulse which the war has given to Meteorology in all its aspects: but a tribute of affectionate memory is due all the same to the rough and ugly little maps that headed *The Times* weather column until 1914. When the isobaric map first appeared it was a small journalistic triumph, for in those days there were no cheap and easy photographic processes for reproducing drawings to print with type, and students of forty years ago remember how this map of the weather appealed to them when they saw it for the first time. Out of fashion and grotesque as the little map would now appear it possessed one advantage which its up-to-date successor lacks: it was just the right size to trace off as a lantern slide, and many University Extension and Gilchrist Trust lecture audiences have seen the weather map published that morning filling a 20-foot screen. Old lecturers on the weather must regret the old map for this reason alone, for they have often traced the isobars by scraping out the lines on a blue waxed plate a few minutes before the lecture began in some remote village where the London newspapers are not delivered until the evening, and made a slide of it by binding the tracing to a cover-glass prepared in advance with the outline of the British Isles in black. The *Morning Post* articles to which we

have referred show that the appeal of "Earth's young significance" still rouses the same enthusiasm which fired those whose efforts to popularize meteorology in the later decades of last century were helped by the old *Times* map. Though we do not wish it back, we retain some gratitude for the enterprise which started it and kept it going during the period of popular indifference, which we trust, has now passed away for ever.

Correspondence.

To the Editor of Symons's Meteorological Magazine

THE SNOWSTORM OF JANUARY 4th AND 5th.

In this country a very low barometer in a winter month, especially, perhaps, in January, when the general level of temperature is at a minimum generally means cold and snow, except when and where a long-distance north-west current from the Atlantic may be transporting warmth. In the little cyclonic depression which moved north-eastward across England from France on the evening of January 3rd, becoming deeper, larger and more intense as it progressed there was no warm current in the circulation at all; but the temperature on the night of the track where the wind was from southerly points, was just high enough to permit of a heavy fall of rain in Northern France and the south-east of England, in place of a very severe snowstorm which visited the north, midlands and west of England, where the winds were from northerly points on the left of the track. The meteorological circumstances of this storm are most interesting, and it is to be hoped that it may be found possible to show on a map the distribution of snow and rain. It is probable that in Kent, Surrey and Sussex, where the temperature was only just high enough for rain, the elevated tracts of country approaching 1,000 feet above the sea, would stand out as altitudinal outlines of the snowfall which in the parts of England lying further west and north was very deep in the lowlands. The experiences of travellers on the Great Western Railway would be interesting if known. Assuming that the transition zone between rain and snow was somewhere in the neighbourhood of Reading, where the fields would be looking grey, a little further west the White Horse Hills would appear as altitudinal outlines of the deep snow which farther west, still in Wilts and Somerset, was lying in the lowlands. Apparently Cornwall in the extreme west lay for the most part outside the area of the storm. There is no doubt that the altitudinal outlines of this heavy lowland snowstorm would be highly instructive could they be depicted on a map. L. C. W. BONACINA.

January, 11th 1919.

A WINTER THUNDERSTORM.

A THUNDERSTORM started on January 10th, at 7 p.m., with a very vivid flash, followed by others at 7.5 and 7.8 p.m.; the first thunder being at 7.8 p.m. Intermittent flashes, with and without thunder, were continued at intervals till 9.45 p.m. Hail fell in large quantities and heavy rain. The wind, which was very light, was from the south-west, and rain continued the whole night.

HAROLD R. PINK.

The Mount, Fareham, January 11th, 1919.

REMARKABLE UNIFORMITY OF TEMPERATURE.

FOR the last ten days, January 28th to February 6th inclusive, the range of temperature here has amounted to only 9°·3. During this period the ground has been snow-covered to the depth of about 3 inches, the sky densely overcast, with frequent falls of snow, the wind light from north to east. The following are the maximum and minimum temperatures in the screen :—

		Max.	Min.			Max.	Min.
January	28th	35°·5	30°·5	February	2nd	32°·5	29°·2
,,	29th	36°·0	28°·7	,,	3rd	33°·2	30°·0
,,	30th	32°·0	31°·0	,,	4th	35°·5	30°·0
,,	31st	30°·5	26°·7	,,	5th	35°·0	30°·0
February	1st	32°·2	27°·0	,,	6th	35°·5	30°·7

H. K. G. ROGERS.

Glenart, Weybridge, February 6th, 1919.

Mr. William Allingham.

WE have to record, with regret, the sudden death, on January 24th, of Mr. William Allingham, for many years Principal Assistant in the Marine Branch of the Meteorological Office. Mr. Allingham's early life was spent at sea, but, owing to a disabling accident, he obtained, in the early seventies, a post in the Admiralty, while in 1875 he was transferred, at the age of twenty-five, to the Staff of the Meteorological Office. In addition to a practical knowledge of Navigation and Meteorology Mr. Allingham was gifted with considerable literary ability. His chief works were the compilation of a *Manual of Marine Meteorology*, and, in conjunction with Captain Wilson-Barker, Commander of H.M.S. *Worcester*, a valuable treatise on *Navigation, Practical and Theoretical*. He edited the later editions of Lecky's *Wrinkles in Practical Navigation*, and was an active contributor to various magazines and journals, among which may be mentioned *The Nautical Magazine*, *The Syren*, and the *Liverpool Journal of Commerce*. F.J.B.

ROYAL METEOROLOGICAL SOCIETY.

THE Annual General Meeting of this Society was held on January 15th, at Burlington House, Sir Napier Shaw, F.R.S., President, in the Chair. The report of the Council for 1918 was read and adopted, and the Council for 1919 was duly elected, as follows :—

President : Sir Napier Shaw, D.Sc., LL.D., F.R.S.; *Vice-Presidents :* T. W. Backhouse, Francis Druce, Capt. A. J. Walker, F. J. W. Whipple; *Treasurer :* W. Vaux Graham, C.E.; *Secretaries:* W. W. Bryant, J. S. Dines; *Foreign Secretary:* R. G. K. Lempfert; *Councillors:* C. E. P. Brooks, Capt. C. J. P. Cave, R.E.; J. E. Clark, Capt. G. M. B. Dobson, Lieut.-Col. E. Gold, D.S.O., R.E., Lieut. H. D. Grant, R.N.V.R., R. H. Hooker, Lieut.-Col. H. Mellish, C.B., Carle Salter, W. Sedgwick, Maj. G. I. Taylor, R.F.C., Prof. H. H. Turner, D.Sc., D.C.L., F.R.S.

Sir Napier Shaw, in an address on "Meteorology : the Society and its Fellows," referred to the change in the position of meteorological work during the war from that of a subject of curiosity which might safely be left to take its chance with such facilities as were left to the ordinary public inexperienced censors and controllers, to that of a matter of such importance in gunnery and navigation of the sea and air that all reference to it was rigorously excluded from the newspapers and a number of special services were improvised to meet the need of meteorological information for our own forces acting in co-operation with corresponding organisations for the French, American and Italian forces. To meet the demand for information about the fundamental principles and practice of the modern science, necessary for those who were called upon to take up technical duties with very limited training, the Meteorological Office had issued a number of books specially written for the purpose. Looking forward, he said that the immediate necessity was the organization of the meteorological services to satisfy the demands of the home countries and meet possible requirements of the dominions beyond the seas. The essential conditions of the organisation were first that there should be a career for men of ability, and secondly that there should be opportunity for suitable preparation by preliminary training in scientific studies, including meteorology, at the universities. At the same time, efficient organization of the public service required that the regular collection of information about the weather should be placed on a proper footing, by arrangement between the central authority and local authorities. The duty which the Society should discharge in the changed conditions was to foster or create an atmosphere which would make a satisfactory national organization on those lines possible by the interchange of ideas and the discussion of meteorological subjects. The steps towards this object would be the continued improvement of the Quarterly Journal of the Society, as a

medium of communication between the fellows, and the development of the use of the library as a reservoir of information. The position of the fellows in relation to the subject would be somewhat changed when the maintenance of the public memory of the weather came to be undertaken as a national duty. But the number of opportunities open to them for active personal co-operation in the development of meteorology, which had not hitherto been fully utilised, was very large. It included observations of special character such as those with self-recording instruments, including the photographic camera, co-operation in making known the progress of the science in other countries, the study of weather in ancient and modern literature and the presentation of a series of episodes in the long history of meteorology and, principally, the setting out of the experience of past and present study in such a way as to create and stimulate the desire for new knowledge upon which the progress of the science must rest.

The following gentlemen were balloted for and elected fellows of the Society :—Capt. J. W. Farnell, Sec.-Lieut. G. F. Henderson, Sec.-Lieut. R. S. Read, Mr. R. Stanley-Davies, Capt. N. B. Weekes, Lieut. F. C. Wood.

METEOROLOGICAL NEWS AND NOTES

DEW POND CONSTRUCTION was described in some detail in a lecture before the Royal Institute of British Architects on February 3rd by Mr. G. Hubbard, F.S.A.. who maintained that it was possible to obtain a water-supply in the absence of springs, rivers and rain, and described an extremely interesting and successful experiment carried out by himself in this connection.

THE NORFOLK RAINFALL ORGANIZATION'S complete monthly rainfall tables, publication of which had been interrupted for some time owing to war conditions, are being resumed in the *Eastern Daily Press* from the beginning of the current year.

PRIZES FOR WEATHER ESSAYS offered to Enfield school boys and girls are announced by the *Enfield Gazette* of January 10th, 1919. The annual prize for 1918 had unfortunately to be withdrawn owing to the Censor's restrictions.

ERRATA.—In this Magazine for January, 1919, page 138, last two lines of table :—*for* 4 years *read* 14 years. Page 139, first line of Mr. Kitchener's letter :—after 18h. 20m. *insert* on December 18th.

METEOROLOGY DURING AND AFTER THE WAR.

A LECTURE on this subject was delivered at the Royal Society of Arts on January 22nd, by Colonel H. G. Lyons, R.E., D.Sc., F.R.S., Acting-Director of the Meteorological Office. The chair was taken by Sir Napier Shaw, D.Sc., F.R.S., Meteorological Adviser to the Government.

Colonel Lyons said that the conditions prevailing at the commencement of hostilities were favourable for the advancement of meteorology. At that time, however, there was hardly a career open as a professional meteorologist, and most men working on meteorology were doing so as a hobby. Much valuable research had been carried out, and many difficulties of forecasting were being swept away. The investigation of the upper atmosphere by kites and pilot balloons had made considerable strides. As a result of the war some of this work had to be abandoned, some new work taken up, and the difficulties of carrying on the vastly increased routine of the Meteorological Office with a depleted staff became a serious problem. The cessation of wireless reports, the absence of meteorological information from Central Europe, and the censorship of letters and telegrams added to the difficulties. The need for information from wider areas was soon appreciated and telegraphic reports are now received from Spitzbergen, the north coast of Africa, the Azores and Central Russia. It was thus possible to form a very fair idea of the weather prevailing over the Central Empires. Increased demands for forecasts from the Admiralty and the Royal Air Force led to the institution of a continuous 24-hour forecast service based on reports at 1 a.m., 7 a.m., 1 p.m. and 6 p.m. Telegraphic reports were transmitted to General Headquarters in France for the use of the Allied Armies. A freely expressed wish of aviators and others for reports devoid of all technical terms resulted in the issue of an early morning report based on observations at 1 a.m. and containing a simple description of the prevailing conditions with a forecast. A fuller report was issued on the 7 a.m. observations, and another on the 1 p.m. observations. This was supplemented, for purposes of the General Staff, by a summary of the conditions prevailing on the various fronts and of the anticipated conditions. The present and probable conditions over the Central Empires were also deduced. The highly confidential nature of the work necessitated the use of cypher codes. The loss of Zeppelins in February, 1915, and October, 1917, as well as numerous occasions when they ran into bad conditions and had to return, lend support to the belief that the enemy was kept ignorant as to weather conditions over Western Europe.

The demands of the Special Brigade for trained meteorologists led to the formation of the Meteorological Section of the Royal Engineers in 1915. The Section began with four officers and twenty

other ranks, and at the close of hostilities had increased to five times that number with units at all Army Headquarters, and a force in Salonika. The Section advised aviators as to upper air conditions and the Artillery as to gun-ranging corrections. In addition to the Military Service, the Meteorological Section of the Royal Air Force and the Admiralty Meteorological Service had achieved fine results.

Colonel Lyons maintained that co-operation in the future would be essential to obtain the best results. The most rapid means of transmission of reports are necessary for the forecaster, and the greater use of wireless telegraphy might be confidently looked for. Strict uniformity in regard to instruments, practice and method were needful. There were about 1,000 well-equipped meteorological stations throughout the Empire and free access to the accumulated data should be possible. H.E.C.

SCOTTISH METEOROLOGICAL SOCIETY.

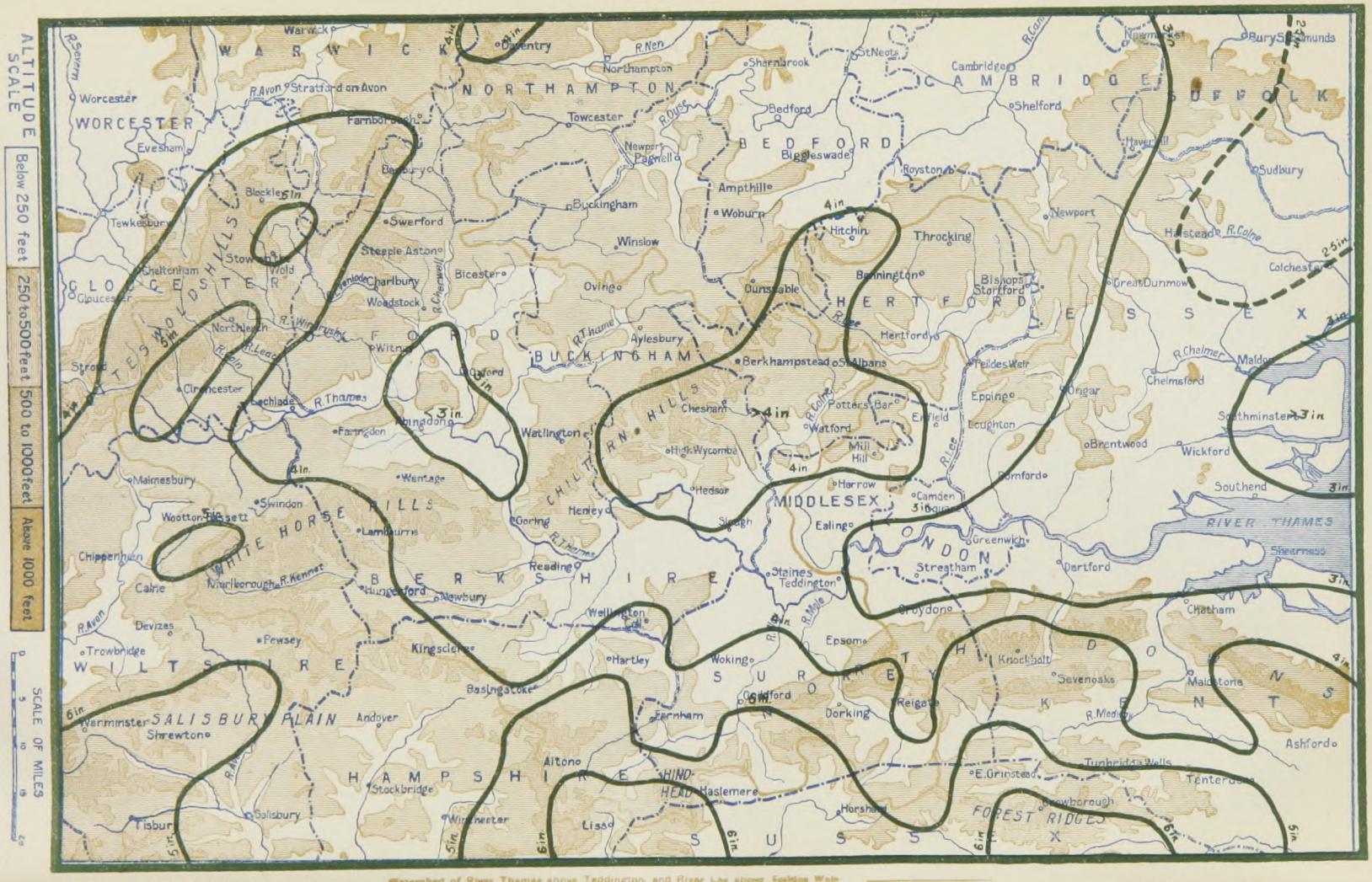
The Annual Business and General Meeting of the Society was held on December 19th, 1918, in the lecture hall of the Royal Society of Edinburgh, Professor R. A. Sampson, F.R.S., and, afterwards, Dr. C. G. Knott, in the Chair.

The report from the Council referred to the great strain imposed by war conditions on the voluntary system of climatological observations, and to the importance of rainfall work. There had been a slight shrinkage in the membership list, but, during the past four very trying years, the loyalty of the members had been conspicuous.

The following Council and Office-bearers were elected for the ensuing twelve months :—*President :* Dr. C. G. Knott ; *Vice-Presidents :* Prof. T. Hudson Beare, and Mr. J. Mackay Bernard ; *Council :* Mr. D. A. Stevenson, Mr. R. Cross, Mr. S. B. Hog, Mr. G. Thomson, Dr. A. Crichton Mitchell, Mr. G. A. Mitchell, Mr. M. M'Callum Fairgrieve, Prof. R. A. Sampson, F. R. S., Capt. T. Bedford Franklin ; *Honorary Secretary :* Capt. E. M. Wedderburn, R.E. : *Honorary Treasurer :* Mr. W. B. Wilson, W.S.

Prof. R. A. Sampson, F.R.S., in a paper on "Microbarometers," communicated some critical and historical notes, discussing early microbarometers, the Royal Society of London's water barometer, Hooke's Wheel barometer, Dines's and Casella's barographs and the Shaw-Dines leak barograph. The paper pointed out the importance of studying simultaneous traces upon a sufficiently large scale, of the different meteorological elements. An instrument with an extremely small leak and of remarkable sensitiveness was in use at the Royal Observatory, Edinburgh, and an exhibit was made of some of its records and the simultaneous pressure-tube anemograms.

THAMES VALLEY RAINFALL. JANUARY, 1919.



THE WEATHER OF JANUARY.

THE flow of Atlantic depressions, which was in operation in December, continued throughout the first three weeks of January. The weather remained therefore in an exceedingly unsettled state, and, owing to a change in the tracks pursued by the various storm systems, its general character was of a more wintry type. In December the centres of depressions had kept as a rule outside our Atlantic seaboard, so that the winds in these islands were mostly from between south and west. In January the storm centres came more immediately over the country and the mild south-westerly wind was therefore interspersed not infrequently with cold winds from some northerly quarter. The most important depressions were those of the 1st, 2nd, the 6th and the 9th, the wind rising on each occasion to the force of a gale in many districts. On the 2nd, the westerly gusts blew with a velocity of 69 miles per hour, at Holyhead, and 85 miles at Southport; while on the 6th the wind exceeded a velocity of 65 miles in several parts of our west and south-west coasts, and reached 78 miles at Pendennis Castle (Falmouth). Between the 3rd and 4th heavy snowstorms were experienced in the west and north of England, causing, locally, considerable interruptions to traffic. During these three weeks of disturbed weather the mean temperature over England was slightly above the average, and no frosts of any great consequence were reported. In Scotland, the air was much colder, sharp frost occurring on the nights of the 6th, the 12th and the 18th; on the last-mentioned occasion the sheltered thermometer fell to 15°, at Balmoral, and 17°, at West Linton, and Eskdalemuir.

The cyclonic period ended between the 26th and 28th with the movement of a depression which came from Iceland and travelled in a south south-easterly direction across Great Britain and France. In its rear strong northerly winds set in, and, on the 27th, heavy snowstorms occurred in many districts, as far south as Hertfordshire. Sharp frost was experienced the same night in Scotland, the thermometer falling to 13° at West Linton and 14° at Kilmarnock. A large anticyclone now developed in the far north, its borders eventually spreading southwards over a large part of Great Britain. Cold winds from east or north-east therefore became general, with sharp wintry weather and occasional falls of snow in many English districts; on the 31st the temperature at a number of the inland stations failed to reach the freezing point all day.

Over the eastern half of the United Kingdom the total duration of bright sunshine was below the average, but in the west there was a fairly general excess. At Richmond (Kew Observatory), the aggregate was little more than half the amount at Bidston, and less than half the amount at Falmouth and Valencia (Cahirciveen).

The rainfall was generally above the average, the excess being most marked in the south-east of England, where more than twice the average amount fell over a wide area. The only appreciable deficiency occurred in the Scottish Highlands, where about 70 per cent. of the average fall was registered at many stations and only 57 per cent. at Fort William. The fall was normal in the south of Ireland, but above the average to the north of Munster. Less than 3 inches fell along the east coast of Great Britain from the Thames to the Firth of Fife, as well as in the extreme north of Scotland and in Dublin. The fall exceeded 6 inches in large areas in Sussex and Hampshire, in the mountains of Wales and Scotland, and in the south-west of Ireland. Part of the English Lake District had more than 10 inches.

The general rainfall expressed as a percentage of the average was :—England and Wales, 155; Scotland, 94; Ireland, 122; British Isles, 124.

In London (Camden Square) the mean temperature was 37°·8 or 0°·7 below the average. The duration of sunshine was 11·5 hours. The duration of rainfall, 89·7 hours, was the highest for January in the 39 years for which records have been kept. Only twice before, in 1912 and 1915, has rain fallen for more than 80 hours in January. There was no recorded evaporation during the month.

RAINFALL TABLE FOR JANUARY, 1919.

STATION.	COUNTY.	RAINFALL. Aver. 1875—1909. in.	1918. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Date.	Nos. of Day
Camden Square	*London*	1·83	3·22	+1·39	176	·41	27	22
Tenterden	*Kent*	2·14	4·93	+2·79	230	·84	10	23
Arundel (Patching)	*Sussex*	2·59	6·13	+3·54	236	·74	28	23
Fordingbridge (Oaklands)	*Hampshire*	2·67	5·99	+3·32	224	·92	3	24
Oxford (Magdalen College)	*Oxfordshire*	1·78	2·85	+1·07	160	·71	3	22
Wellingborough (Swanspool)	*Northampn*	1·90	3·76	+1·86	198	·77	3	23
Bury St. Edmunds (Westley)	*Suffolk*	1·70	2·67	+ ·97	157	·46	1	20
Geldeston [Beccles]	*Norfolk*	1·53	2·98	+1·45	195	·56	5	25
Polapit Tamar [Launceston]	*Devon*	3·59	6·46	+2·87	180	·81	6	25
Rousdon [Lyme Regis]	,,	2·94	5·37	+2·43	183	·76	19	22
Stroud (Field Place)	*Gloucester*	2·33	3·07	+ ·74	132	·79	15	12
Church Stretton (Wolstaston)	*Shropshire*	2·51	3·47	+ ·96	138	·47	1	21
Boston	*Lincoln*	1·54	2·94	+1·40	191	·48	3	24
Worksop (Hodsock Priory)	*Nottingham*	1·70	3·00	+1.30	177	·92	3	20
Mickleover Manor	*Derbyshire*	1·95	3·60	+1·65	185	1·10	3	20
Congleton (Buglawton Vic.)	*Cheshire*	2·26	2·92	+ ·66	129	·37	3	23
Southport (Hesketh Park)	*Lancashire*	2·55	4·17	+1·62	164	·45	1	23
Wetherby (Ribston Hall)	*York, W.R.*	1·89	3·37	+1·48	178	·73	4	15
Hull (Pearson Park)	,, *E.R.*	1·70	3·02	+1·32	178	·58	3	19
Newcastle (Town Moor)	*North'land*	1·90	2·89	+ ·99	152	·55	4	21
Borrowdale (Seathwaite)	*Cumberland*	13·44	13·00	— ·44	97	...	...	...
Cardiff (Ely)	*Glamorgan*	3·65	5·74	+2·09	157	·89	1	25
Haverfordwest	*Pembroke*	4·69	6·25	+1·56	133	·70	13	25
Aberystwyth (Gogerddan)	*Cardigan*	3·91	5·66	+1·75	145	·55	28	24
Llandudno	*Carnarvon*	2·51	2·76	+ ·25	110	·39	9	26
Cargen [Dumfries]	*Kirkcudbrt.*	4·10	4·01	— ·09	98	·65	2	23
Marchmont House	*Berwick*	2·40	4·06	+1·66	169	·81	4	21
Girvan (Pinmore)	*Ayr*	4·78	5·16	+ ·38	108	·85	2	27
Glasgow (Queen's Park)	*Renfrew*	3·53	3·59	+ ·06	102	·74	2	20
Islay (Eallabus)	*Argyll*	4·78	6·89	+2·11	144	1·08	1	26
Mull (Quinish)	,,	5·55	5·43	— ·12	98	·97	23	24
Loch Dhu	*Perth*	9·20	6.55	—2·65	71	·95	13	19
Dundee (Eastern Necropolis)	*Forfar*	2·01	2·60	+ ·59	129	·80	1	22
Braemar	*Aberdeen*	2·92	2·68	— ·24	92	...	...	...
Aberdeen (Cranford)	,,	2·36	3·29	+ ·93	140	·65	20	21
Gordon Castle	*Moray*	1·99	3·96	+1·97	199	...	...	...
Drumnadrochit	*Inverness*	3·63	2·73	— ·90	75	·40	4	22
Fort William	,,	9·20	5·22	—3·98	57	·70	13	19
Loch Torridon (Bendamph)	*Ross*	9·42	6·60	—2·82	70	1·09	25	21
Dunrobin Castle	*Sutherland*	2·75	1·98	— ·77	72	·30	16	13
Glanmire (Lota Lodge)	*Cork*	4·70	4·74	+ ·04	101	·84	6	22
Killarney (District Asylum)	*Kerry*	5·94	5·95	+ ·01	100	·62	13	27
Waterford (Brook Lodge)	*Waterford*	3·78	4.02	+ .24	106	·45	6	23
Nenagh (Castle Lough)	*Tipperary*	3·88	3·78	— ·10	97	·53	9	21
Ennistymon House	*Clare*	4·30	6.66	+2·36	155	·79	13	22
Gorey (Courtown House)	*Wexford*	3·19	4·52	+1·33	142	·49	4	22
Abbey Leix (Blandsfort)	*Queen's Co.*	3·15	...	...	...	...	...	...
Dublin (FitzWilliam Square)	*Dublin*	2·14	2·64	+ ·50	123	·34	4	25
Mullingar (Belvedere)	*Westmeath*	3·10	3·71	+ ·61	120	·50	17	20
Crossmolina (Enniscoe)	*Mayo*	5·35	6·80	+1·45	127	·98	13	27
Cong (The Glebe)	,,	4·79	...	...	...	...	...	...
Collooney (Markree Obsy.)	*Sligo*	3·87	5·31	+1·44	137	·72	13	25
Seaforde	*Down*	3·41	4·49	+1·08	132	62	7	24
Ballymena (Harryville)	*Antrim*	3·73	4·87	+1·14	131	·70	13	26
Omagh (Edenfel)	*Tyrone*	3·46	4·63	+1·17	134	.80	13	21

SUPPLEMENTARY RAINFALL, JANUARY, 1919.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches
II.	Warlingham, Redvers Road .	4·65	XI.	Lligwy	4·34
,,	Ramsgate.....	2·55	,,	Douglas, Isle of Man	5·27
,,	Hailsham	5·98	XII.	Stoneykirk, Ardwell House...	4·53
,,	Totland Bay, Aston House...	4·81	,,	Carsphairn, Shiel.....	7·11
,,	Stockbridge, Ashley..	4·82	,,	Langholm, Drove Road	5·57
,,	Grayshott.....	6·56	XIII.	Selkirk, The Hangingshaw..	3·67
,,	Upton Nervet	3·62	,,	North Berwick Reservoir... ..	3·55
III.	Harrow Weald, Hill House...	3·93	,,	Edinburgh, Royal Observaty.	2·06
,,	Pitsford, Sedgebrook.....	3·68	XIV.	Biggar.....	3·00
,,	Woburn, Milton Bryant.....	3·95	,,	Maybole, Knockdon Farm ...	3·72
,,	Chatteris, The Priory.....	2·57	XV.	Ardgour House	7·12
IV.	Elsenham, Gaunts End	3·22	,,	Shiskine	5·36
,,	Shoeburyness	...	,,	Oban.....	4·46
,,	Colchester, Hill Ho., Lexden	2·35	,,	Holy Loch, Ardnadam.....	7·13
,,	Aylsham, Rippon Hall.... ..	2·88	,,	Loch Venachar.....	5·95
,,	Swaffham	3·08	XVI.	Glenquey	5·40
V.	Bishops Cannings	4·12	,,	Loch Rannoch, Dall	4·00
,,	Weymouth.....	5·49	,,	Blair Atholl	2·31
,,	Ashburton, Druid House.....	8·98	,,	Coupar Angus	2·94
,,	Cullompton	6·00	,,	Montrose, Sunnyside Asylum.	3·23
,,	Lynmouth, Rock House	6·17	XVII.	Balmoral	3·23
,,	Okehampton, Oaklands.....	6·59	,,	Fyvie Castle	3·68
,,	Hartland Abbey.....	5·28	,,	Keith Station	5·89
,,	St. Austell, Trevarna	6·83	XVIII.	Rothiemurchus.....	2·79
,,	North Cadbury Rectory.....	4·91	,,	Loch Quoich, Loan	11·45
VI.	Clifton, Stoke Bishop	4·75	,,	Skye, Dunvegan	6·28
,,	Ledbury, Underdown..... ...	3·15	,,	Fortrose.....	1·72
,,	Shifnal, Hatton Grange.....	2·59	,,	Glencarron Lodge	5·23
,,	Droitwich.....	3·27	XIX.	Tongue Manse	2·49
,,	Blockley, Upton Wold.....	4·75	,,	Melvich	2·39
VII.	Grantham, Saltersford.....	3·47	,,	Loch More, Achfary	5·84
,,	Louth Westgate	3·43	XX.	Dunmanway, The Rectory ..	6·44
,,	Bawtry, Hesley Hall	2·82	,,	Mitchelstown Castle.....	6·02
,,	Derby, Midland Railway.....	3·17	,,	Gearahameen	10·70
VIII.	Nantwich, Dorfold Hall	2·04	,,	Darrynane Abbey.....	8·16
,,	Bolton, Queen's Park	4·70	,,	Clonmel, Bruce Villa	4·63
,,	Lancaster, Strathspey	4·99	,,	Roscrea Timoney Park	3·40
IX.	Langsett Moor, Up. Midhope	5·04	,,	Broadford, Hurdlestown.....	4·88
,,	West Witton	4·84	XXI.	Enniscorthy, Ballyhyland...	5·23
,,	Scarborough, Scalby	3·44	,,	Rathnew, Clonmannon	3·60
,,	Ingleby Greenhow	3·61	,,	Hacketstown Rectory	4·49
,,	Mickleton	2·90	,,	Ballycumber, Moorock Lodge	3·11
X.	Bellingham, High Green Manor	3·98	,,	Balbriggan, Ardgillan	2·89
,,	Ilderton, Lilburn Cottage ...	3·64	,,	Castle Forbes Gardens.....	3·78
,,	Keswick, The Bank.....	5·69	XXII.	Ballynahinch Castle.....	7·37
XI.	Orton.....	7·05	,,	Woodlawn	2·17
,,	Llanfrechfa Grange	6·22	,,	Westport House	5·59
,,	Treherbert, Tyn-y-waun	11·71	,,	Dugort, Slievemore Hotel ...	7·50
,,	Carmarthen, The Friary	6·68	XXIII.	Enniskillen, Portora.....	5·45
,,	Fishguard, Goodwick Station.	5·53	,,	Dartrey [Cootehill]	3·98
,,	Crickhowell, Tal-y-maes.....	7·50	,,	Warrenpoint, Manor House ..	3·98
,,	Birmingham WW., Tyrmynydd	6·54	,,	Belfast, Cave Hill Road	4·65
,,	Lake Vyrnwy	8·43	,,	Glenarm Castle	4·78
,,	Llangynhafal, Plas Drâw.....	2·93	,,	Londonderry, Creggan Res...	4·22
,,	Rhiwbryfdir	8·06	,,	Milford House	4·09
,,	Dolgelly, Bryntirion.....	5·68	,,	Killybegs	5·61

Climatological Table for the British Empire, August, 1918.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches.		
London, Camden Square	89·7	22	46·9	30	74·1	54·2	54·7	71	100·5	47·3	1·78	12	6·6
Lagos	85·2	26	69·0	12	82·5	72·2	70·9	79	145·0	64·0	1·32	10	7·3
Cape Town	91·2	24	42·8	1	71·3	51·3	49·7	65	...	...	·22	4	2·8
Johannesburg	71·0	20	33·3	2	60·7	41·3	34·6	65	...	31·0	3·66	6	3·2
Bloemfontein	73·5	20	26·9	15	64·5	35·9	39·6	73	..	...	1·82	4	2·1
Calcutta...	91·6	1	75·1	9	88·4	78·8	78·0	87	...	72·9	10·77	16	4·0
Madras	104·1	4	74·8	11	97·3	73·9	66·0	71	164·1	71·7	3·06	12	6·4
Colombo, Ceylon ...	86·8	3	73·5	5	85·6	77·2	72·8	79	155·4	70·8	2·09	18	8·6
Hongkong	87·1	25	74·0	3	83·6	76·4	74·8	86	...	...	29·23	20	8·1
Sydney	75·9	29	42·9	27	65·5	48·8	47·8	75	125·0	36·0	2·51	...	5·6
Melbourne	65·1	21	34·1	1	59·9	45·3	44·5	73	120·8	25·6	2·73	17	6·6
Adelaide	69·0	4	36·6	2	61·7	46·1	46·0	74	126·5	28·6	2·63	14	5·6
Coolgardie	77·0	25	35·5	8	63·6	43·4	40·5	58	140·0	30·0	·67	5	5·9
Brisbane	78·0	29	45·5	13	72·1	51·1	50·4	66	134·6	40·1	1·24	11	3·5
Hobart, Tasmania ..	64·4	27	35·9	20	56·3	43·8	40·0	66	118·6	31·2	3·53	14	6·3
Wellington ...	62·7	3	30·5	11	54·9	43·3	41·7	75	124·0	20·6	3·51	13	5·9
Jamaica, Kingston ..	94·2	2, 28	69·8	5	90·1	73·6	71·6	77	...	...	2·87	4	4·0
Grenada	84·0	15	71·0	15*a*	86·0	75·0	...	76	138·0	...	6·55	16	3·5
Toronto	102·2	13	47·8	1	81·7	59·6	61·0	79	160·0	42·5	4·15	11	4·4
Fredericton	86·5	24	39·0	19	74·2	50·3	54·7	74	...	...	1·05	10	4·5
St. John, N.B. ...	79·2	20	46·5	28	66·0	53·1	52·3	80	137·0	39·5	1·98	11	8·8
Victoria, B.C.	80·0	30	48·8	27	67·0	51·9	53·0	82	140·4	39·8	1·78	14	4·2

a—19.

Johannesburg.—Bright sunshine 240·7 hours.

COLOMBO, CEYLON.—Mean temp. 81°·4, or 0°·2 above, dew point 0°·7 below, and R ·54 in. below, averages. Mean hourly velocity of wind 6·3 miles.

HONGKONG.—Mean temp. 79°·5. Bright sunshine 136·7 hours. Mean hourly velocity of wind 12·0 miles.

Melbourne.—Mean temp. one of the highest for past years, and R ·92 in. above average.

Adelaide.—Mean temp. equal to, and R ·13 in. above, averages.

Coolgardie.—Temp. 0°·1 below, and R ·25 in. below, averages.

Brisbane.—Temp. 0°·4 above, and R ·99 in. below, averages. Fog on 15 days.

Wellington.—Mean temp. 0°·7 above, and R 1·06 in. below, averages. Bright sunshine, 149·4 hours.

Symons's
Meteorological Magazine.

No. 638. MARCH, 1919. Vol. LIV.

Capt. Melville Willis Campbell Hepworth, C.B., R.D., R.N.R.

Cheltenham, 27th April, 1849—Ealing, 25th February, 1919.

The death of Captain Campbell Hepworth, following so soon after that of Mr. Allingham, is a serious loss to the Marine Division of the Meteorological Office, of which he had been Superintendent since 1899. Captain Hepworth was a son of the Rev. Robert Hepworth, of Cheltenham, and entered the merchant service. He had experience also in the Indian Marine and as a Naval Reserve officer in the Royal Navy. He was always keenly interested in the scientific as well as in the professional aspects of a sea-faring life, and when in command of liners on the Australian passage, both by the Suez Canal route and between Sydney and Vancouver, he made valuable observations on meteorology and currents. His appointment to the Marine Branch of the Meteorological Office gave him a welcome opportunity for encouraging meteorological observations at sea, and he was indefatigable in working up and publishing the results of the increasing number of well-kept meteorological logs. Amongst the very numerous publications of the Meteorological Office issued under his superintendence none owed more to his personal initiation and impetus than the monthly or quarterly pilot-charts of the oceans, showing the average conditions of weather, ocean-currents, and floating ice. Apart from the usefulness of these charts to the careful mariner, they served as fascinating companions for the scientific passenger and we have often been struck when at sea with the remarkable accuracy of the charts in fixing the positions of the limits of the trade winds at different seasons.

Captain Hepworth was engaged officially in many interesting pieces of oceanographical discussion, amongst which may be mentioned the surface isotherms of the Southern Ocean and the investigation of the ice drifts in the North Atlantic. More purely meteorological were his "Barometer Manual for the use of Seaman," and his "Seaman's Handbook of Meteorology." Almost his last work was the encouragement of rainfall observations at sea, and the

introduction on the back of the Monthly Pilot Charts of tables of rainfall from ship's logs.

Captain Hepworth communicated many valuable papers to different scientific and professional societies during the last thirty-five years, and an interesting selection of these was published in 1907 under the title of "Notes on Maritime Meteorology." The first paper in that volume is a lecture delivered to the United Service Institution in 1896, on "Meteorology: a factor in Naval Warfare," showing that Captain Hepworth took his naval responsibilities no less seriously than his nautical and scientific duties.

As a colleague Captain Hepworth was helpful and considerate, while his retiring and kindly disposition endeared him to innumerable friends afloat and ashore.

THE CARE OF THE BAROGRAPH,

Hints to Amateurs.

By Lieut. A. S. Martin-Smith.

I suppose that a considerable number of people include a barometer in the list of items, useful or otherwise, but generally considered necessary, to complete the equipment of the average home. Undoubtedly the primary consideration is very often not so much a question of its practical utility, but rather of its being a conventional article of furniture which is more or less ornamental, and at the same time, it is hoped, will convey to one's friends that which is not otherwise obvious, namely a suggestion of learning or at least of an interest in things scientific.

It also serves as a direct encouragement, if, indeed, such be necessary, to introduce as a topic of conversation that subject about which the man in the street is never tired of exposing his profound ignorance.

In most cases no effort is made to get the best out of the household barometer, and especially is this the case with the self-recording variety; and a casual glance into the windows of the shops of most opticians will show that insufficient care seems to be taken by even the very people whose business it is to exhibit them for sale.

I am not, however, concerned here with these people, but rather with the private individual who really does take an intelligent interest and a certain amount of justifiable pride in his barograms, which could be, but rarely are, made use of in investigations. I invite such a person to examine his records and ask himself whether or no his traces are as near perfection as the limitations of his instrument will permit.

In any investigation of line squalls or similar phenomena, an

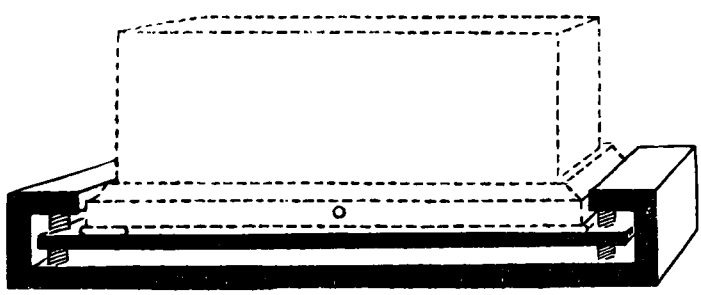
examination of barograms should disclose well-defined sudden oscillations in the trace at or about the time of the occurrence. Unless the instrument receives judicious treatment and adjustment and is carefully timed, the records will prove of little or no value for future reference in such cases.

It is quite a simple matter to ink the pen-nib properly and not a very difficult operation to reduce to a minimum the pressure of the pen against the paper, yet how seldom is this done. Perhaps it would be the lesser evil to underestimate the quantity of ink required and to err on the side of having too slight a contact of pen with paper.

One frequently finds blurred traces caused by a faulty pen; and sometimes a succession of vertical intervals is the only indication of what in reality should be represented by a continuous curve. This is due to an excess of friction which prevents any movement of the pen when it proves stronger than the impulse created by the compression or otherwise of the vacuum chambers.

Granted, however, every care has been taken in these details, there is still a difficulty to be overcome.

There is the question of jolts and jars due to irrepressible domestic activity and careless shutting of doors and shaking of floors inseparable from most houses, this in addition to occasional accidental jostling of the instrument itself. To eliminate, or, at least, modify



this disturbing effect, some years ago, I constructed a simple shock-absorbing contrivance which has certainly answered the purpose very well indeed. The barograph is placed upon a wooden platform which is supported above and below, at both ends, by spiral springs, borrowed from some spring dumb-bells, as shown in the accompanying illustration.

The principle is not new, but I have not heard of its application in this direction and can recommend its use to those in similar circumstances who desire to obtain the best results from what for the individual can prove to be for practical purposes the most interesting and useful of all meteorological instruments.

ROYAL METEOROLOGICAL SOCIETY.

THE usual monthly meeting of this Society was held on Wednesday February 19th, at 70, Victoria Street, S.W.. Sir Napier Shaw, F.R.S., President, in the Chair.

Dr. S. Chapman read a paper on "The lunar tide in the Earth's atmosphere." The lunar tidal variation of barometric pressure had been well determined at Batavia, from fifty years' hourly records, and from data extending over about five years in each case at St. Helena, Singapore, Rome and Samoa. As very little was known about its dependence on latitude, season, and the distance, declination and phase of the moon, a new and detailed discussion has been made of thirty and twenty-eight years' records of barometric pressure at Batavia and Hong Kong, respectively. The results were considered alongside the pre-existing values from the stations above-named, together with the Greenwich determination recently published in in the *Quarterly Journal* of the Royal Meteorological Society. The amplitude varies approximately as the fourth power of the cosine of the latitude, while the phase varies somewhat irregularly from 33° (Samoa) to 114° (Greenwich), where 90° corresponds to the occurrence of maximum pressure when the moon is on the meridian. No dependence on lunar phase or declination was detected, while as regards the moon's distance, an increase of amplitude from apogee to perigee was observable, though less than the increase in the tide-producing force. Distinct evidence of a seasonal variation of amplitude and phase was shown by both the Hong Kong and Batavia determinations. The conclusion was that the lunar atmospheric tide is not a simple tidal phenomenon, but is complicated by other effects, notably by resonance with an adjacent free period of vibration of the atmosphere, and possibly also by more local causes, such as the rise and fall of the ocean.

Major G. I. Taylor spoke on the effect of resonance and the wind variations due to variations in pressure. Mr. E. C. Barton, Mr. W. W. Bryant and Mr. F. J. W. Whipple also took part in the discussion.

Mr. Miller Christy read a paper, entitled, "The Gunfire on the Continent during 1918 : its audibility at Chignal St. James, near Chelmsford." Observations on the audibility of the continental gunfire have been made by the author for four years. The results for previous years were brought forward in earlier papers. In 1918 the first sounds were heard on the evening of May 8th and the last on August 26th, thus confirming previous experience that there is audibility at the writer's post of observation in Essex only during the summer months. The period of audibility in 1918 amounted to 15 weeks, 5 days. In previous years the periods were : 1915, 17 weeks, 3 days ; 1916, 15 weeks ; 1917, 19 weeks, 4 days. The

average for the four years is 17 weeks. A feature of 1918 was that the sounds were less loud and distinct than in previous years, and there were none of the periods of extreme loudness which had before been noticed.

Mr. J. E. Clark said that at Purley he heard distant gunfire on 48 days, between May 31st and August 25th. It was heard daily from July 25th to August 11th. Mr. E. C. Barton quoted from a report of a bombardment in Upper Alsace on January 21st, 1917, which was audible on the slopes of the Jura and in Switzerland. Atmospheric conditions seemed to be important for the air was clear where firing was heard and foggy where it was not heard.

Mr. Miller Christy also contributed some notes on two whirlwinds in Essex. On October 27th, 1916, the village of Writtle suffered damage to the extent of £3,000 to £4,000, and thousands of oaks and elms were badly damaged. On July 27th, 1918, the parish of Gosfield suffered, though damage was less severe, the track of the whirl being mostly in open country. Major Blair said the great storms of the United States were similar though of longer duration. The sharply defined and narrow track of the storm was also characteristic.

The following candidates were balloted for and elected Fellows of the Society :—Capt. K. G. Stacy Hatfield, G. C. Singleton, Donald Stevenson, Adolph Zaiman.

Correspondence.

To the Editor of Symons's Meteorological Magazine

MILD WINTER IN THE EASTERN UNITED STATES.

Up to the present the winter in this vicinity and generally in the eastern part of the country has been one of the mildest in many years. It has been a vivid and delightful contrast to that of 1917-1918, which was one of great severity, with heavy and continued snowfalls. So far I have measured only three-quarters of an inch of snow, while at the same period last year more than twenty inches had fallen. There have been no important storms, the depressions of the barometer being insignificant. Temperature has averaged well above the normal, the lowest minimum 9° against 5° below zero last year. January was genial, almost balmy, yet in Alaska great cold was experienced, temperature sinking to 62° below zero.

CHARLES DECKER.

Narberth, Pa., U.S.A., February 5th, 1919.

AN OLD WEATHER RECORD.

THE enclosed extract relates to the year 1667 :—

"Whereas upon the Thirteenth Day of October last, Between The hours of three and Four in the Afternoon it pleased the Lord to Visct the Town of Welbourn with a sad and Dreadfull Judgment, there was Thunder hail-stones as big as Pigeons Eggs. Congealed and Sharp pointed and some smart Cracks there was A Continued thunder for about a Quarter of an hour together And a tedious Dismal Storm Ensued that in Less then Four Minutes blew Down four and fourty Dwelling houses. as also their Barns Stables and hovels and Stacks and That which remained Spoiled with Rain that fell upon It before it Could Possibly be Gathered togather. The Werlwind Carried the Breadth of a Eleven or Twelve Score yards it had the Appearance of fire and a Sulphruas smell the Day wonder Full Dark and throw houses trees into all Quarters East West North and South. It pleased God to Spare their Lives but only one Youth that was Slain. The Close as above Mentioned as appears unto us by Certificate Subscribed by The Hands of Tho. Lumb John Rafer and Willm. Glascow who was appointed to View the same amounting to the value of Six hundred pounds fourteen Shillins."

The above describes a storm at Welbourn, in Lincolnshire. One of the chief occupiers was a George Blaney, amongst whose papers I have found this account. The Blaneys are ancestors of my paternal grandmother, and as I have many of their papers there seems no reason to doubt the genuiness of the above account.

Colmer Rectory, Alton, Hants., Jan. 27th, 1919. A. C. HERVEY.

REMARKABLE UNIFORMITY OF TEMPERATURE.

MR. H. K. G. ROGERS has drawn attention to the low range of temperature during the ten days, January 28th to February 6th, and it may be of some interest to compare with his result the figures for Headley, near Epsom about 575 ft. above sea-level.

		Max.	Min.			Max.	Min.
January	28th	32°·5	30°·9	February	2nd	29°·8	27°·7
,,	29th	33°·8	29°·0	,,	3rd	30°·8	28°·1
,,	30th	29°·2	29°·0	,,	4th	34°·8	28°·6
,,	31st	27°·8	24°·1	,,	5th	33°·4	29°·2
February	1st	30°·9	24°·8	,,	6th	35°·0	30°·3

Mean at Weybridge.	*Mean at Headley.*
33°·8 Max. 29°·4 Min. 4°·4 Range.	31°·8 Max. 28°·2 Min. 3°·9 Range.

An interesting point which I have long noted in cloudy weather of the north-easterly type, when the temperature range is small, is the marked frequency with which the maximum occurs at night. This happened here on no less than four out of the ten nights under review, viz., on January 29th, 31st, February 1st and 6th.

THEODORE E. R. PHILLIPS.

Headley Rectory, Epsom.

SNOWSTORM OF JANUARY 4th AND 5th.

WITH reference to my suggestion in the February number of "altitudinal outliers" of the snowfall in Kent, Surrey, and Sussex, I should be much interested to know whether Observers in those counties within sight of elevated tracts like the North and South Downs, Ashdown Forest, Leith Hill or Hindhead, noted any snow lying on the higher ground on the dates in question. I would like while writing to draw attention to an error in the fourth line of my letter in the February number, which resulted in the printing of north-west instead of south-west. I am particularly sorry about this because there is a great difference between the characteristic temperature of a W. and a S.W. wind in these islands, and a N.W. wind, taking the year through is, together with a N. wind, the coldest, being in summer cooler than N.E.

L. C. W. BONACINA.

Hampstead, March 2nd, 1919.

[Mr. D. W. Horner writes, in reference to the snowstorm of January 4th and 5th, that at Moretonhampstead, on the borders of Dartmoor, snow fell to a depth of 6 inches before 9 a.m. on the 5th, yielding ·68 in. in the rain gauge. The height above sea-level is 642 ft. At Ipplepen (273 ft.) there was no snow, only rain and sleet, ·96 in. being measured.—ED., *S.M.M.*]

WEATHER MAPS IN NEWSPAPERS.

WITH regard to your very interesting article on the above subject, may I point out that although it was *The Times* that inaugurated the daily weather map in newspapers in 1875, it was to the enterprise of the *Daily News* that a system of telegraphic and railway weather reports was started as far back as 1849. May it not truly be said that these reports from various stations were the pioneers of the present-day weather map, or synoptic chart?

In connection with the fact that the *Morning Post* has now followed the example of *The Times* in reproducing a daily weather chart, it may be recalled that previous to the war the only other newspaper to emulate *The Times* was the short-lived *Tribune*, which used to print a weather map on the lines of those supplied to American newspapers by the United States Weather Bureau.

D. W. HORNER, F.R.Met.Soc.

Moretonhampstead, Devon, February 20th, 1919.

[The *Daily Telegraph* has now to be added to the list of daily papers issuing the 6 p.m. Meteorological Office Weather Map, covering the breadth of two columns. *The Times* has diminished the scale of its Weather Map to the breadth of one column, with some loss of distinctness.—ED., *S.M.M.*]

SNOW FOLLOWING FINE WEATHER.

SUNDAY, March 2nd, was a glorious soft warm sunny day, a striking contrast to the previous weather. From observation of similar occurrences in previous years at this season I forecasted snow in three days. This came to-day, March 5th, when snow fell heavily for some hours in the afternoon. What is the explanation?

CHARLES P. HOOKER, F.R.Met.Soc.

Cirencester, March 5th, 1919.

WIND BACKING ROUND THE COMPASS.

ON January 8th, at 8 a.m., the wind was due S., at 8.30 it had backed to S.E., and I expected heavy rain from a depression passing to the south, but only a few hundredths of fine rain fell. The wind continued to back, and at 10 a.m. was E., at noon, N.E., at 1 p.m., N., and at 2 p.m. W. There was a calm all this time, but much gloom with cloud level 600-700 feet. There was a clearance from the W. at 2 p.m. and some sun afterwards, but no wind. At 5 p.m. it had gone to S.W., and at 7.30 p.m. it was back once more at due S. and freshening. I conclude this shift of wind all round the compass in less than twelve hours was due to a very shallow disturbance surrounded by deep ones. There was no fall of barometer, only a temporary cessation in its rise. At 10.30 p.m. heavy rain set in with a freshening southerly wind and falling barometer.

R. P. DANSEY.

Kentchurch Rectory, Hereford, January 9th, 1919.

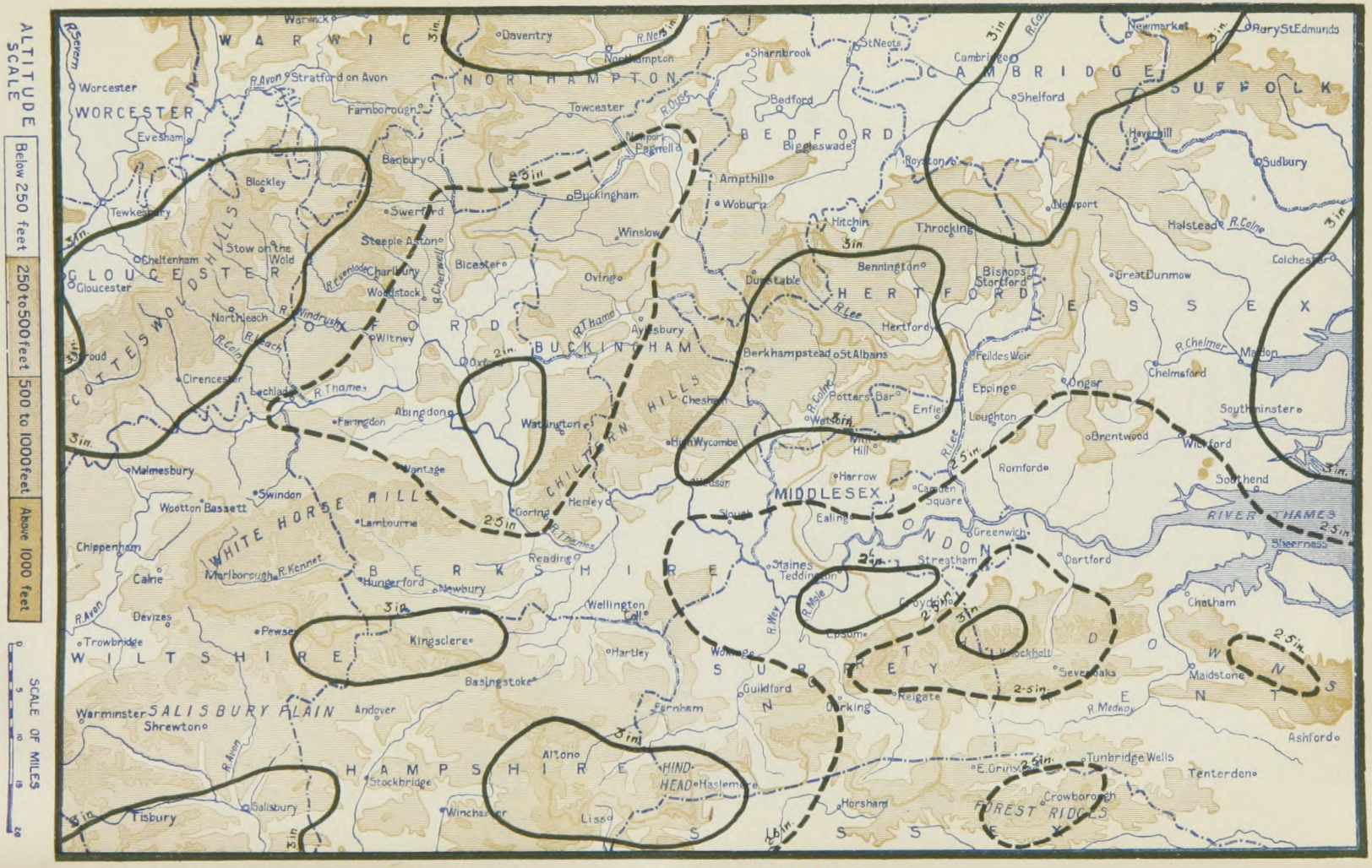
METEOROLOGICAL NEWS AND NOTES.

THE MUNSTER RAINFALL ASSOCIATION, founded by Mr. E. W. M. Murphy, of Cashel, co. Tipperary, has issued its first annual report, dealing with the rainfall of 1918. Records are given for the province of Munster and the adjoining counties, but the primary object of the Association is the encouragement of rainfall observing in Ireland generally, and we are glad to hear that a promising start has been made in the directon of securing the establishment of new stations.

ACTIVITY in establishing new rainfall stations is also manifesting itself in Wales, where the matter is being taken up by many of the County Councils, the observations being made in most cases at the schools. This is an example which we hope will be widely followed.

ERRATA.—In this Magazine for February, 1919, p. 3, the following corrections are required in Mr. Bonacina's letter on the Snowstorm of January 4th and 5th. Line 4, *for* north-west *read* south-west. Line 9, *for* night *read* right. Lines 20 and 26, *for* outlines *read* outliers.

THAMES VALLEY RAINFALL. FEBRUARY. 1919.



THE WEATHER OF FEBRUARY.

A SHORT spell of cold easterly winds at the beginning of the month (a legacy from January) was followed on Febuary 4th by the arrival of a cyclonic disturbance off the Irish coasts. Over a large portion of the country the wind therefore veered temporarily to the southward, and between the 5th and 7th the thermometer in most of the western districts rose above 50°, a reading as high as 56° being recorded at Killarney. On the 6th, the formation of a small secondary disturbance near the mouth of the English Channel was attended by heavy rain in Devon and Cornwall, the system afterwards moving south-eastwards across France to the Mediterranean.

A large anticyclone now began to extend from Northern Europe, and between about the 7th and 13th practically the whole of Great Britain was under the influence of a frost, which in spite of its comparative brevity, was sufficiently severe to permit of the indulgence of skating in nearly all districts. The lowest temperatures were observed between the 8th and 11th, when the sheltered thermometer fell below 20° at nearly all inland stations, a reading as low as 5° being recorded at West Linton, and a reading of 9° at Raunds. On the surface of the grass the thermometer naturally went a few degrees lower, and at Hemel Hempstead, early on the 9th, it touched zero Fahr. In several places there were three or four consecutive days upon which the thermometer in the screen failed to reach the freezing point all day. A good deal of night and morning fog was experienced at the time over eastern and central England, but with those exceptions the weather was exceedingly fine, the total duration of bright sunshine in the week ended the 15th being equal to considerably more than half the possible at many coast stations in the west and south. In the north the air was sometimes exceedingly dry; at Eskdalemuir the relative humidity on the 9th and 10th sank respectively to a minimum of 17 per cent. and 18 per cent.

During the latter half of the month the weather was influenced for the most part by depressions which advanced eastwards over the southern half of the United Kingdom. In the north, where the wind was usually from some easterly quarter, the weather remained essentially wintry, sharp frosts being experienced in Scotland about the nights of the 17th and 27ths. Further south the wind was more variable, but even there the thermometer seldom reached its average level, snow being experienced in nearly all parts of the kingdom between the 16th and 18th, and again in many northern and central districts, between the 26th and 28th.

Bright sunshine exceeded the average in many western districts but was below it in the east; at Kew Observatory the total duration for the month amounted to little more than half the usual February allowance. On the night of the 27th a brillant display of aurora was observed in nearly all the western and northern districts, and on the following night it was again seen in Scotland.

The rainfall was above the average over the greater part of England and Wales, except in the north-west, and below the average over Scotland and Ireland. In the south and east of England some stations had nearly twice the average fall. The deficiency was most marked in the English Lake District and in the normally rainy areas of Scotland. The total was less than 4 inches over the whole of Great Britain except South Wales, Devon and Cornwall. North of a line joining the Mersey and the Wash, it was less than 2 inches, except at a few scattered stations where this amount was slightly exceeded. Many stations in the north-east of Ireland had less than an inch of rain, and 3 inches was only exceeded in the south and west. The general rainfall expressed as as a percentage of the average was :—England and Wales, 103; Scotland, 38; Ireland, 69; British Isles, 71.

In London (Camden Square), the mean temperature was 35°·6 being 4°·1 below the average, and 2°·2 lower than in January. The duration of sunshine was 11·3 hours, and of rain, 71·3 hours. Evaporation ·13 inch.

RAINFALL TABLE FOR FEBRUARY, 1919.

STATION.	COUNTY.	RAINFALL. Aver. 1875–1909. in.	1919. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Date.	Nos. of Day
Camden Square	*London*	1·66	2·64	+ ·98	159	·64	16	14
Tenterden	*Kent*	1·90	2·30	+ ·40	121	·53	16	16
Arundel (Patching)	*Sussex*	2·17	2·77	+ ·60	128	·60	19	11
Fordingbridge (Oaklands)	*Hampshire*	2·34	3·23	+ ·89	138	·95	16	17
Oxford (Magdalen College)	*Oxfordshire*	1·62	2·10	+ ·48	130	·69	16	14
Wellingborough (Swanspool)	*Northampn*	1·70	2·43	+ ·73	143	·82	16	12
Bury St. Edmunds (Westley)	*Suffolk*	1·59	2·97	+1·38	186	·76	17	12
Geldeston [Beccles]	*Norfolk*	1·41	2·07	+ ·66	147	·60	16	16
Polapit Tamar [Launceston]	*Devon*	2·95	3·35	+ ·40	114	·70	16	15
Rousdon [Lyme Regis]	,,	2·50	4·58	+2·08	183	1·08	16	13
Stroud (Field Place)	*Gloucester*	2·12	2·88	+ ·76	136	·91	14	...
Church Stretton (Wolstaston)	*Shropshire*	2·17	...	...	...	...	...	...
Boston	*Lincoln*	1·53	2·40	+ ·87	157	1·00	16	11
Worksop (Hodsock Priory)	*Nottingham*	1·64	2·63	+ ·99	160	·93	16	12
Mickleover Manor	*Derbyshire*	1·71	2·22	+ .51	130	·52	17	9
Congleton (Buglawton Vic.)	*Cheshire*	1·95	·91	—1·04	47	·26	21	11
Southport (Hesketh Park)	*Lancashire*	2·07	1·10	— ·97	53	·50	19	8
Wetherby (Ribston Hall)	*York, W.R.*	1·71	1·55	— ·16	91	·53	16	8
Hull (Pearson Park)	,, *E.R.*	1·78	1·91	+ ·13	107	·73	16	14
Newcastle (Town Moor)	*North'land*	1·63	2·22	+ ·59	136	·36	20	15
Borrowdale (Seathwaite)	*Cumberland*	10·96	1·57	—9·39	14	...	...	...
Cardiff (Ely)	*Glamorgan*	3·07	4·52	+1·45	147	1·13	21	15
Haverfordwest	*Pembroke*	3·42	3·97	+ ·55	116	·77	21	17
Aberystwyth (Gogerddan)	*Cardigan*	3·09	2·62	— ·47	85	·52	19	8
Llandudno	*Carnarvon*	2·11	1·19	— ·92	56	·28	22	12
Cargen [Dumfries]	*Kirkcudbrt.*	3·42	1·28	—2·14	37	·41	15	8
Marchmont House	*Berwick*	2·15	3·04	+ ·89	141	·67	20	17
Girvan (Pinmore)	*Ayr*	3·87	1·06	—2·81	27	·75	23	5
Glasgow (Queen's Park)	*Renfrew*	2·70	·60	—2·10	22	·30	15	4
Islay (Eallabus)	*Argyll*	3·91	1·22	—2·69	31	·27	6	11
Mull (Quinish)	,,	4·45	1·08	—3·37	24	·36	22	11
Loch Dhu	*Perth*	6·69	1·60	—5·09	24	·40	15	9
Dundee (Eastern Necropolis)	*Forfar*	1·91	1·86	— ·05	97	·35	22	15
Braemar	*Aberdeen*	2·55	1·09	—1·46	43	·41	20	7
Aberdeen (Cranford)	,,	2·36	1·97	— ·39	83	·50	20	16
Gordon Castle	*Moray*	1·95	1·55	— ·40	80	...	...	...
Drumnadrochit	*Inverness*	2·89	1·07	—1·82	37	·38	22	11
Fort William	,,	6·85	·64	—6·21	9	·19	18	9
Loch Torridon (Bendamph)	*Ross*	7·53	1·40	—6·13	19	·39	22	8
Dunrobin Castle	*Sutherland*	2·58	1·92	— ·66	74	·46	15	7
Glanmire (Lota Lodge)	*Cork*	3·76	3·93	+ ·17	105	·75	18	14
Killarney (District Asylum)	*Kerry*	4·99	2·36	—2·63	47	·55	22	15
Waterford (Brook Lodge)	*Waterford*	3·18	4.01	+ ·83	126	·86	4	16
Nenagh (Castle Lough)	*Tipperary*	2·89	2·03	— ·86	70	·51	21	11
Ennistymon House	*Clare*	3·44	2.56	— ·88	74	·41	6	13
Gorey (Courtown House)	*Wexford*	2·75	3·53	+ ·78	128	·45	4	16
Abbey Leix (Blandsfort)	*Queen's Co.*	2·55	1·96	— ·59	77	·54	21	15
Dublin (Fitz William Square)	*Dublin*	1·93	1·40	— ·53	73	·26	5	16
Mullingar (Belvedere)	*Westmeath*	2·67	1·87	— ·80	70	·38	21	12
Crossmolina (Enniscoe)	*Mayo*	4·20	2·14	—2·06	51	·38	5	16
Cong (The Glebe)	,,	3·72						
Collooney (Markree Obsy.)	*Sligo*	3·20	1·23	—1·97	38	·30	6	12
Seaforde	*Down*	2·81	1·99	— ·82	71	56	15	12
Ballymena (Harryville)	*Antrim*	2·99	·66	—2·33	22	·17	19	9
Omagh (Edenfel)	*Tyrone*	2·68	·86	—1·82	32	.40	7	5

SUPPLEMENTARY RAINFALL, FEBRUARY, 1919.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches
II.	Warlingham, Redvers Road..	3·21	XI.	Lligwy	1·28
,,	Ramsgate	1·93	,,	Douglas, Isle of Man	1·57
,,	Hailsham	2·92	XII.	Stoneykirk, Ardwell House...	·93
,,	Totland Bay, Aston House...	2·83	,,	Carsphairn, Shiel	1·08
,,	Stockbridge, Ashley..	2·61	,,	Langholm, Drove Road	·99
,,	Grayshott	3·27	XIII.	Selkirk, The Hangingshaw..	1·55
,,	Upton Nervet	2·71	,,	North Berwick Reservoir.....	1·92
III.	Harrow Weald, Hill House...	2·84	,,	Edinburgh, Royal Observaty.	1·75
,,	Pitsford, Sedgebrook.....	3·30	XIV.	Biggar.....	·58
,,	Woburn, Milton Bryant.....	2·96	,,	Maybole, Knockdon Farm ...	·12
,,	Chatteris, The Priory.....	2·73	XV.	Shiskine	1·36
IV.	Elsenham, Gaunts End	2·92	,,	Ardgour House	1·06
,,	Shoeburyness	2·25	,,	Oban.....	1·17
,,	Colchester, Hill Ho., Lexden	2·98	,,	Holy Loch, Ardnadam.....	1·18
,,	Aylsham, Rippon Hall.... ..	2·75	,,	Loch Venachar.....	·70
,,	Swaffham	2·57	XVI.	Glenquey	1·30
V.	Bishops Cannings	2·29	,,	Loch Rannoch, Dall	·53
,,	Weymouth.....	3·67	,,	Blair Atholl	·97
,,	Ashburton, Druid House.....	9·03	,,	Coupar Angus	1·21
,,	Cullompton	3·58	,,	Montrose, Sunnyside Asylum.	2·15
,,	Lynmouth, Rock House	3·31	XVII.	Balmoral	1·45
,,	Okehampton, Oaklands... ...	3·65	,,	Fyvie Castle	1·91
,,	Hartland Abbey.....	3·83	,,	Keith Station	1·78
,,	St. Austell, Trevarna	7·51	XVIII.	Rothiemurchus	·66
,,	North Cadbury Rectory.....	2·49	,,	Loch Quoich, Loan	·95
VI.	Clifton, Stoke Bishop	3·27	,,	Skye, Dunvegan	2·02
,,	Ledbury, Underdown..... ...	3·22	,,	Fortrose.....	1·31
,,	Shifnal, Hatton Grange.....	2·48	,,	Glencarron Lodge	1·09
,,	Droitwich.....	2·19	XIX.	Tongue Manse	1·94
,,	Blockley, Upton Wold.....	3·42	,,	Melvich	1·41
VII.	Grantham, Saltersford.....	2·81	,,	Loch More, Achfary	2·00
,,	Louth Westgate	2·90	XX.	Dunmanway, The Rectory ..	5·76
,,	Bawtry, Hesley Hall	2·27	,,	Mitchelstown Castle.....	2·80
,,	Derby, Midland Railway.....	2·30	,,	Gearahameen	4·80
VIII.	Nantwich, Dorfold Hall	1·73	,,	Darrynane Abbey.....	4·64
,,	Bolton, Queen's Park	1·15	,,	Clonmel, Bruce Villa	2·22
,,	Lancaster, Strathspey	1·68	,,	Roscrea Timoney Park	2·13
IX.	Langsett Moor, Up. Midhope	2·26	,,	Broadford, Hurdlestown.....	1·75
,,	West Witton	2·17	XXI.	Enniscorthy, Ballyhyland...	4·01
,,	Scarborough, Scalby	1·69	,,	Rathnew, Clonmannon	3·26
,,	Ingleby Greenhow	1·45	,,	Hacketstown Rectory	2·45
,,	Mickleton	1·80	,,	Ballycumber, Moorock Lodge	1·53
X.	Bellingham, High Green Manor	2·02	,,	Balbriggan, Ardgillan	1·65
,,	Ilderton, Lilburn Cottage ...	1·98	,,	Castle Forbes Gardens.....	1·57
,,	Keswick, The Bank.....	·70	XXII.	Ballynahinch Castle.....	3·02
,,	Orton.....	1·36	,,	Woodlawn	1·60
XI.	Llanfrechfa Grange	5·96	,,	Westport House	1·70
,,	Treherbert, Tyn-y-waun	7·21	,,	Dugort, Slievemore Hotel ...	2·46
,,	Carmarthen, The Friary	3·90	XXIII.	Enniskillen, Portora.....	·97
,,	Fishguard, Goodwick Station.	2·29	,,	Dartrey [Cootehill]	1·18
,,	Crickhowell, Tal-y-maes.....	4·00	,,	Warrenpoint, Manor House ..	1·59
,,	Birmingham WW., Tyrmynydd	3·98	,,	Belfast, Cave Hill Road	1·65
,,	Lake Vyrnwy	3·17	,,	Glenarm Castle	3·24
,,	Llangynhafal, Plas Drâw.....	2 93	,,	Londonderry, Creggan Res...	1·06
,,	Rhiwbryfdir	3·25	,,	Milford Manse	1·15
,,	Dolgelly, Bryntirion.....	2·81	,,	Killybegs	1·50

Climatological Table for the British Empire, September, 1918.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	72·3	6	37·2	29	64·8	49·5	...	82	86·0	34·0	5·68	24	6·0
Malta	95·0	8	61·0	29	85·1	72·5	...	77	140·0	60·5	·80	2	0·4
Lagos	87·3	16	70·0	19	84·7	74·0	72·8	80	158·3	66·0	3·71	16	7·1
Cape Town	82·9	2	38·5	23	67·5	51·5	52·1	77	...	...	1·86	13	5·7
Johannesburg	78·9	11	37·0	7	71·4	51·1	42·8	61	...	34·0	·95	4	3·5
Mauritius	78·0	26*a*	55·0	10	76·0	61·0	58·0	70	...	49·0	·90	16	5·6
Bloemfontein	84·1	22*b*	34·8	6	72·6	46·3	43·9	61	..	...	2·25	7	5·6
Calcutta...	94·4	19	74·9	27	90·1	78·6	77·8	84	...	73·4	9·31	14	7·9
Madras	101·1	7	72·8	23	94·5	78·1	74·7	77	166·9	71·9	3·25	8	6·2
Colombo, Ceylon ...	88·1	17	72·8	18	86·8	76·7	71·7	76	164·8	68·5	1·06	11	7·6
Hongkong	89·8	11	72·4	30	83·5	76·5	73·2	81	...	...	18·45	17	6·4
Melbourne	81·3	26	34·2	7	64·9	45·7	43·1	61	133·1	22·8	3·44	14	4·3
Adelaide	86·8	26	38·2	22	68·4	47·2	45·4	60	145·1	28·3	·66	7	...
Coolgardie	93·0	30	37·5	4	75·9	48·7	42·4	44	155·5	33·5	·11	2	4·0
Brisbane	82·1	28	45·9	2	74·5	53·5	52·2	65	141·4	39·1	1·98	5	3·1
Hobart, Tasmania .	77·9	26	35·1	7	59·6	44·2	39·2	58	132·9	26·3	2·60	16	5·4
Wellington ...	62·8	27	36·2	11	56·4	46·0	44·3	73	131·0	24·5	3·51	14	7·2
Jamaica, Kingston ..	91·9	7	71·2	27	90·0	73·9	72·3	78	...	...	·30	3	4·3
Grenada	90·0	4	72·0	13*c*	86·0	76·0	...	76	138·0	...	9·80	15	3·5
Toronto	80·6	3	39·0	22	65·6	47·3	47 9	84	131·2	34·0	4·64	18	5·8
Fredericton	77·0	3	30·8	12	65·5	45·1	49·1	80	...	...	8·02	15	5·4
St. John, N.B. ...	74·5	6	36·5	11	62·0	49·2	50·1	83	133·3	31·3	7·00	13	6·1
Victoria, B.C.	82·8	28	44·2	24	68·6	51·2	49·0	72	136·0	38·0	·10	2	2·4

a—27, 29. *b*—23. *c*—19.

Johannesburg.—Bright sunshine 267·2 hours.

COLOMBO, CEYLON.—Mean temp. 81°·7, or 0°·7 above, dew point 1°·7 below, and R 3·48 in. below, averages. Mean hourly velocity of wind 5·6 miles.

HONGKONG.—Mean temp. 79°·6. Bright sunshine 171·3 hours. Mean hourly velocity of wind 11·5 miles.

Melbourne.—Mean temp. 1°·3 above, and R 1·02 in. above, averages.

Adelaide.—Mean temp. 0°·8 above, and R ·66 in. below, averages. The lowest September fall with two exceptions in past 79 years.

Coolgardie.—Temp. 3°·6 above, and R from ·25 to ·50 in. below, averages.

Brisbane.—Temp. and R slightly below averages.

Hobart.—Temp. and R above averages.

Wellington.—Mean temp. 0°·3 below, and R ·63 in. below, averages. Bright sunshine, 148·5 hours. TS and H on the 18th.

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REPORT OF WATER POWER COMMITTEE.

The Board of Trade Committee on the Water Power Resources of the United Kingdom, of which Sir John Snell is Chairman, has issued an Interim Report to the President of the Board of Trade which has been published by the Stationery Office as Cmd. 79 of 1919, at the price of 2d. The Report deals not with the total resources of the country but with certain specific schemes for developing water-power in the Scottish Highlands. These are representative of many others and were selected as typical instances in which large powers could be economically developed. The value of the schemes depends partly on the possibility of transmitting electrical energy to industrial centres at a distance from the generating station and partly on the possibility of establishing new industries on the sea-board close to the source of power. In both cases the controlling factor is the cost of the necessary works and this is based on the reports of eminent engineers accustomed to the planning of large works, such as the Foyers and Kinlochleven establishments of the British Aluminium Company and the North Wales works of the British Aluminium Corporation. All the estimates are based on pre-war contract prices, plus fifty per cent. The Committee states that a Water Power scheme producing 5,000 electrical horse-power continuously and fully utilised will compare favourably with the best coal-fired electric generators of equal power with coal at 10s. per ton, if the capital cost of the undertaking does not exceed £60 per e.h.p.

Nine schemes are indicated in the Report on which work could be commenced as soon as the necessary Parliamentary powers are obtained. These range from 7,200 e.h.p., at Loch Morar, to 42,000 e.h.p. for a combined system of Lochs Ericht, Laidon, Rannoch and Tummel, and the estimated capital cost varies from £17 per e.h.p. for a 9,500 e.h.p. station, at Kilmorack Falls, to nearly £46 per e.h.p. for a 38,000 e.h.p. scheme at Lochs Laggan and Treig. The total electrical horse power of the nine schemes set out is estimated at 183,500, the total estimated cost at £7,075,000, which works out at £38·5 per e.h.p. on the average. The nine schemes would produce power equal to that yielded by 1,850,000 tons of

coal per annum, a figure which shows how absurd was the estimate of the Royal Commission on Coal Supplies in 1906 that all the available water power of the British Isles would be equivalent only to 1,200,000 tons of coal per annum. We are not aware that the Royal Commission referred to took any steps to obtain an authoritative estimate of the water power of the country, and their bad shot suggests that they did not. On the other hand we must bear in mind that the dreams of unlimited power to be obtained from water, which are frequently expounded in the newspapers, are even wider of the mark. The true value of the water power of any country can only be determined by careful and long continued surveys.

We cannot enter here into all the interesting features of this Report, but we must express our appreciation of the wise action of the Government in initiating a thorough enquiry into the subject, the results of which will doubtless be more fully developed in subsequent Reports. We may, however, quote from the concluding paragraphs which are of a general nature and point the way to future developments :—

> "There is no question that a river system and its drainage area must be taken as a unit and dealt with as a whole in regard to all the water problems incidental thereto. In this connection the Committee desires to draw attention to the recommendations of Lord Elgin's Commission on Salmon Fisheries, 1902, which advocated, *inter alia*, the setting up of Watershed Boards under a Supreme Rivers Authority. . . .
>
> The Committee wishes to draw attention to the fact that the estimates of water power dealt with in this Report have only been made possible by the voluntary work of Rainfall Observers in all parts of the British Isles, which has been collected and discussed by the British Rainfall Organization during the past 58 years. If the fullest use is to be made of the water-power resources of this country, it is essential that the work of observation should not only continue, but should be encouraged and developed.
>
> Another branch of observation which has a vital bearing upon the question of water-power resources is the gauging of the flow of rivers. Great attention has been given to this subject in Canada and the United States, but only a small amount of observation has hitherto been carried out in this country.
>
> Strong evidence has been submitted to the Committee regarding the lack of adequate training facilities in the Universities and Technical Institutes of the United Kingdom for young engineers wishing to enter the field of hydro-electric development. In view of the very large extension of water power development that is practically certain to take place in the near future, both in this country, in the British Empire, and in other countries, the Committee consider it important in the interests of British industry, that steps should be taken to remedy this state of affairs. . . ."

ROYAL METEOROLOGICAL SOCIETY.

THE usual annual lecture of this Society was delivered on Wednesday the 19th March, at the rooms of the Geological Society, Burlington House, by Professor Leonard Hill, F.R.S., the subject being "Atmospheric Conditions which affect Health." The President of the Society, Sir Napier Shaw, F.R.S., was in the Chair.

The lecturer first considered how far published meteorological data explained the influence of weather and climate on health and comfort, and in what way these data might be amplified to gain a better insight into this important matter. Numerous Observers make records of barometric pressure, temperature, rainfall, wind, etc., but the question arises as to whether there are not other data of greater importance and interest, which affect personal health and comfort and which might be recorded by them. Barometric pressure is measured with much refinement of accuracy, but we have no sensibility of the pressure of the atmosphere, which acts equally upon all parts of the body. In the past much has been made of the chemical alteration of the air in crowded places, and a false doctrine has become established and made popular. Careful analysis has shown that neither is there such a deficiency of oxygen or an excess of carbonic acid or other poisonous gas in the air of crowded rooms as to affect the health of human beings. Our feelings are largely due to swelling of the membrane of the nose and of its air sinuses. The victims of the Black Hole of Calcutta died from heat stroke, not from a poisonous vitiation of the air by the exhalations of the crowd. It is the cooling and evaporative power of the atmosphere, and the radiant heat of the sun, or other source of radiant energy, which have a colossal effect on our comfort and well-being, and it is these factors which require to be measured by the student of hygiene. The dry-bulb temperature does not suffice to indicate the cooling effect, because it is a static instrument averaging the influence of the environment, while the body is a dynamic instrument keeping itself at a nearly constant body temperature by the internal combustion of food and by heat loss from the skin and respiratory membrane, the heat gain and loss both being physiologically controlled. It is cooling power acting on the body surface, not temperature, which we require to study, and as the surface of the respiratory membrane is always wet and the skin may be made relatively dry or very wet by physiological control evaporative cooling is of no less importance than cooling by convection and radiation. To estimate cooling power Prof. Hill has introduced the kata-thermometer. This is a large bulbed spirit thermometer graduated between 100 and 95°F., giving a mean temperature of 36·5°C. which is arbitrarily taken as the surface temperature of the body. The instrument is heated in water at about 80°C., until the meniscus enters the small bulb at the top

of the stem ; the rate of cooling from 100° to 95°F. is then measured in seconds. Three to five such measurements are made and the average taken gives the dry kata reading. The bulb is then covered with a wetted muslin glove, and the operation repeated. The average gives the wet kata reading. Many thousands of kata observations have been taken in this country, also many in India, Egypt, Salonica front, Mesopotamia ; also some in New York, Nigeria and Melbourne. These admit of a contrast between indoor and outdoor conditions, and the conclusion is reached by Prof. Hill that the ordinary indoor conditions of this country approximate to outdoor conditions in such a humid tropical climate as Ceylon, admittedly an enervating climate to Europeans.

The following Candidates were balloted for and elected Fellows of the Society :—Lieut. H. C. Abraham, Lieut. R. P. Batty, F. G. Beaumont, Lieut. D. F. Bowering, Lieut. A. Mervyn Davies, W. E. Frankenburg, R. E. Horton, A. A. Kidson, Samuel Kniveton, Miss L. F. Lewis, A. H. Lupton, Sergt. F. L. Nunn, Sapper E. N. Redsell, C. F. Reed, T. A. Small, Lieut. A. Stocks.

METEOROLOGICAL OBSERVATIONS AT LU-KIA-PANG, CHINA, FOR 1918.

By Rev. J. de Moidrey S.J.

We have again been favoured by the kindness of Rev. J. de Moidrey, S.J., with summaries of the meteorological observations for 1918 at Lu-Kia-Pang, China, drawn up on similar lines to those for previous years, the first of which, for the year 1914, appeared in this Magazine for April, 1916. The records up to 1913 inclusive were published in the *Meteorologische Zeitschrift*.

I.—*Barometric Pressure. Millibars.*

	8 a.m.	2 p.m.	8 p.m.	Daily Mean.
Jan.	**1030·42**	**1028·29**	**1029·79**	**1029·57**
Feb.	26·19	24·19	25·41	25·31
Mar.....	21·86	20·15	21·06	21·02
April	15·43	14·05	14·78	14·70
May	11·47	09·94	10·12	10·43
June	06·96	05·82	06·24	06·26
July	*02·78*	*01·76*	*02·31*	*02·19*
Aug.	08·20	06·99	07·55	07·47
Sept.	12·24	10·58	11·70	11·40
Oct.	20·35	18·51	19·69	19·44
Nov.	24·24	22·41	23·82	23·44
Dec.	26·13	23·95	25·20	25·08
Year	1017·19	1015·55	1016·47	1016·36

IV.—*Mean amount of Cloud.*

Jan.	2·2
Feb.	6·7
Mar.	7·1
April	7·6
May	7·4
June	**8·7**
July	6·9
Aug.	5·6
Sept.	5·8
Oct.	4·9
Nov.	6·8
Dec.	8·0
Year	6·5

V.—*Days with Thunderstorms.*

Jan	—
Feb.	—
Mar.	—
April	2*a*
May	2
June	2
July	3
Aug.	8
Sept.	—
Oct.	—
Nov.	2*b*
Dec.	—
Year	19

a First, April 20 *b* Last, November 5.

II.—*Temperature. Degrees Centigrade.*

	MEAN DAILY.			MINIMUM.				
	Mean.	Lowest.	Highest.	Mean.	Hour. A.M. hr.	min.	Lowest.	Highest.
	°	°	°	°			°	
Jan.	*+0·27*	*—3·2*	+3·5	*—4·6*	4	55	*—8·2*	+0·5
Feb.	5·43	+1·2	15·7	+1·5	5	25	—4·0	11·9
Mar.	7·82	1·9	15·6	4·1	4	40	—2·9	11·0
April	13·44	7·7	20·3	9·8	4	10	+1·7	15·6
May	18·73	12·4	23·4	14·2	4	0	7·8	19·9
June	23·08	18·3	29·3	19·7	3	40	14·0	25·0
July	26·97	22·6	29·2	23·7	3	55	20·8	**25·8**
Aug.	**27·24**	23·8	**29·8**	**23·8**	4	5	21·3	25·3
Sept.	22·87	17·2	27·8	19·1	4	45	12·3	25·2
Oct.	17·42	14·2	21·2	13·1	4	40	8·6	19·5
Nov.	11·07	4·9	18·9	8·0	4	55	0·5	17·4
Dec.	6·84	—0·6	11·9	4·9	4	35	—4·6	10·4
Year	15·10	—3·2*a*	29·8*b*	11·4	4	30	—8·2*c*	25·8*d*

Latest frost, March 2nd (—2°·9); earliest, December 10th (—0°·3).

II.—(*con.*)

	MAXIMUM					RANGE.		
	Mean.	Hour. P.M. hr.	min	Lowest.	Highest.	Mean.	Lowest.	Highest.
	°			°		°	°	°
Jan.	*+6·9*	14	10	*+1·2*	+13·4	**11·5**	4·3	16·8
Feb.	10·9	13	55	3·7	26·1	9·4	2·5	**19·4**
Mar.	12·6	13	50	5·3	25·5	8·5	2·6	19·2
April	18·1	13	35	10·6	29·1	8·3	*1·3*	17·5
May	24·4	13	40	15·5	31·0	10·2	3·7	14·9
June	27·3	13	35	20·9	34·7	7·6	2·3	14·6
July	31·3	14	5	24·8	**35·6**	7·6	2·1	10·8
Aug.	**32·0**	13	40	26·0	35·4	8·2	3·5	11·2
Sept.	28·4	13	25	22·0	33·5	9·2	5·0	13·1
Oct.	23·7	13	5	18·2	27·1	10·6	2·8	15·5
Nov.	15·3	13	15	10·4	23·1	7·3	1·8	15·4
Dec.	9·6	13	10	2·8	15·1	*4·6*	*1·3*	11·2
Year	20·0	13	35	1·2*e*	35·6*f*	8·6	1·3*g*	19·4*h*

a Jan. 8. *b* Aug. 16. *c* Jan. 3. *d* July 8. *e* Jan. 7. *f* July 27. *g* April 6, Dec. 22. *h* Feb. 25

III.—*Relative Humidity. Per Cent.*

	RELATIVE HUMIDITY.			VAPOUR TENSION.		
	Mean.	Lowest.	Highest.	Mean.	Lowest.	Highest.
Jan.	*60*	*42*	82	*2·7*	*1·7*	4·6
Feb.	73	44	94	4·9	2·9	8·4
Mar.	79	54	97	6·6	4·0	9·5
April	80	55	95	9·7	6·2	14·9
May	71	48	95	12·2	8·0	17·2
June	81	62	**98**	17·9	12·1	24·8
July	**83**	68	97	22·6	19·1	**26·1**
Aug.	81	68	94	**22·8**	17·6	24·5
Sept.	77	57	94	16·8	8·3	23·8
Oct.	76	60	89	11·9	8·6	16·8
Nov.	80	61	97	8·4	4·7	15·4
Dec.	83	69	**98**	6·4	3·2	9·5
Year	77	42	98	11·9	1·7	26·1

(*To be continued*).

Correspondence.

To the Editor of Symons's Meteorological Magazine

RAINFALL AT HAVANA AND IN SOUTH-WEST ENGLAND.

For several years past attention has been drawn to the connection between the rainfall at Havana during the wet season, May to October, and that subsequently experienced in the south-west of England during the three months, January to March. This connection is shown by the correlation coefficient of —0·54, and implies that a heavy seasonal rainfall at Havana should be followed by a light rainfall during January to March in England S.W., and *vice versa*.

During May to October, 1918, the rainfall at Havana was only 42 per cent. of the fifty years' average, being the smallest amount for the season since the record started in 1859. In the south-west England for the three months now just closing the rainfall has been phenomenally heavy, the total being 155 per cent. of the average, and the wettest three first months of the year since at least 1878. Nine weeks out of the thirteen have been wetter than the average, one or two showing very large totals.

The following table gives the seasonal figures for the two districts during the past few years.

	Havana, May-October.	England, S.W., Jan.-March following.		Havana, May-October.	England, S.W. Jan.-March following.
1905 ..	49	148	1912 ..	108	139
1906 ..	143	66	1913 ..	87	138
1907 ..	60	84	1914 ..	71	129
1908 ..	116	82	1915 ..	82	126
1909 ..	101	116	1916 ..	74	67
1910....	108	81	1917 ..	57	94
1911 ..	66	146	1918 ..	42	155

A. HAMPTON BROWN.

70, Victoria Street, S.W. 1, March 31st, 1919.

SNOW FOLLOWING FINE WEATHER.

The following considerations seem to show that the sequence of weather to which Dr. C. P. Hooker calls attention in your last issue, where an exceptionally fine day in early spring is followed by snow within a short period, is capable of a reasonable explanation. It not infrequently happens that a short period of brilliantly fine

weather is found in the rear of an anticyclone which is being pushed away eastward by a depression advancing towards this country from the Atlantic. If the advancing depression takes a southerly track and moves up the English Channel the cold north or north-east winds in its rear may very probably be accompanied by snowfall in the south of England, and thus snow following shortly after a brilliantly fine day is seen to be not improbable. On the other hand there must surely be many such fine days which are unassociated with a subsequent snowfall. If Dr. Hooker could supply the dates in previous years on which he has noticed this phenomenon it would be easy to test the above hypothesis. A study of the synoptic charts for the date in early March quoted in his letter shows that that occasion was of this type although it did not form a very good example and I doubt whether the fineness of March 2nd extended over a very wide area. At Benson, in South Oxfordshire, it was, as far as I remember, not an exceptionally fine day.

66, Sydney Street, S.W. 3, March 27th, 1919. J S. DINES.

THE SLING OR WHIRLED PSYCHROMETER.

In the number of years in which I have been an interested reader of your Magazine I am unable to recall any reference or discussion as to the respective merits of wet and dry bulb thermometers and the sling, or whirled psychrometer. For some years I have been obtaining the relative humidity and dew point from the former, and not very long ago made a series of comparisons of the readings of both instruments. The wet and dry bulb thermometers were exposed in a standard instrument shelter, and sling psychrometer was whirled in the immediate vicinity facing the wind. I found such a wide difference in the readings that I have discarded the older instrument and now use the sling. In fact I do not consider the records observed on the old type as scientifically accurate.

The United States Weather Bureau began the use of the sling psychrometer in 1886. In connection with this instrument they say :—

> "The most reliable instrument for this purpose (to observe the difference between the temperatures indicated by wet and dry bulb thermometers) is the sling, or whirled psychrometer. In special cases rotary fans, or other means, may be employed to move the air rapidly over the thermometer bulbs. In any case satisfactory results cannot be obtained from observations in relatively stagnant air. A strong ventilation is absolutely necessary to accuracy."

When temperatures are below the freezing point the ease and celerity with which observations can be taken with the sling is very satisfactory. CHAS. DECKER.

Narberth, Pa., U.S.A., February 14th, 1919.

WET FIRST QUARTER OF YEAR.

I find that only twice during eighty years have we had more than 12 inches of rain in the first quarter of any year, and my object in looking up the figures was to find out whether there were droughts in the following quarters.

I send you the result of my search and the eighty years average.

	First Quarter in.	Second Quarter in.
Average 1839-1918 ..	6·48	5·34
,, 1844 ..	12·17	2·09
,, 1866 ..	12·76	3·96
,, 1919 ..	12·92	—

West Gate, Chichester, April 1st, 1919. G. ASHLEY TYACKE.

THE rainfall at Totland Bay during the first quarter of the year 1919 amounts to 12·48 in. Our average here for this period is 6·46 in. The only first quarters giving over 10 inches total during my residence of thirty-three years have been :—

	1897	*1900*	*1906*	*1912*	*1919*
January ..	2·45	3·60	6·80	4·12	4·81
February ..	3·41	5·07	3·13	2·62	2·83
March ..	4·30	1·47	1·44	3·41	4·84
Total ..	10·16	10·14	11·37	10·15	12·48

JOHN DOVER.

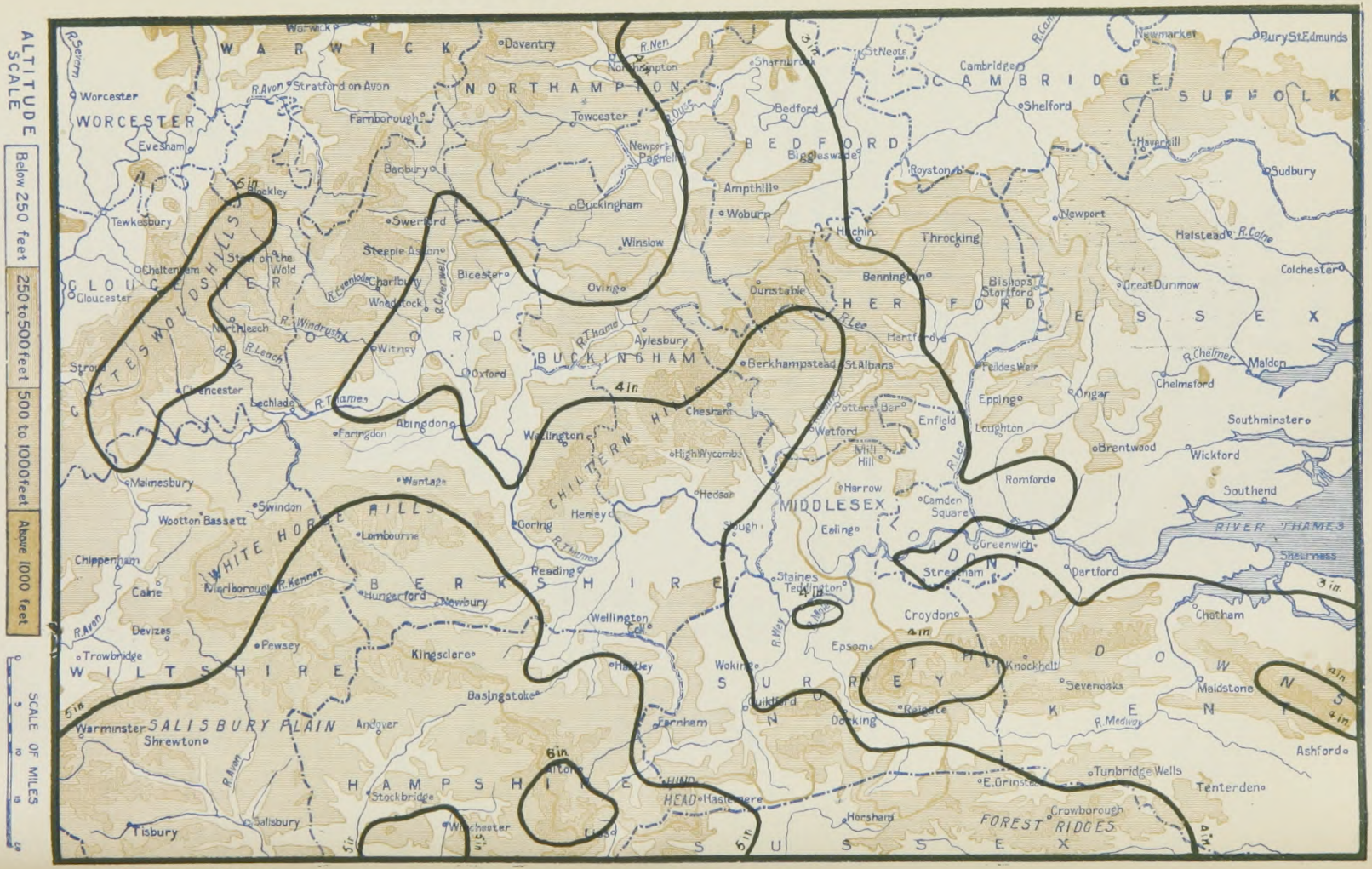
Aston House, Totland Bay, Isle of Wight, 1st April, 1919.

REMARKABLE UNIFORMITY OF TEMPERATURE.

THE phenomenon mentioned by the Rev. T. E. R. Phillips of a fall of temperature by day and a rise by night during cold, cloudy, easterly weather in winter is one which I have often noticed; but I believe it is more pronounced in the south of England than elsewhere. The explanation, I believe, is that in this type of weather there is severe cold on the Continent, often with clear skies, and the low temperature of early morning is carried to our shores by the east wind in the course of the day, while the higher temperature of the sunny daytime on the Continent similarly arrives during the following night. Our skies are cloudy owing to the vapour gathered by the wind in crossing the North Sea, hence the warming influence of the sun by day is shut out from us. I have noticed this inversion of the usual temperature change here in Lincolnshire, but it used to be more pronounced in Hertfordshire. ALLAN ELLISON.

Althorpe Rectory, Lincolnshire. March 27th, 1919.

THAMES VALLEY RAINFALL. MARCH. 1919.


ALTITUDE SCALE
Below 250 feet
250 to 500 feet
500 to 1000 feet
Above 1000 feet
SCALE OF MILES
0 5 10 15 20
WARWICK
WORCESTER
GLOUCESTER
NORTHAMPTON
BEDFORD
BUCKINGHAM
HERFORD
CAMBRIDGE
SUFFOLK
ESSEX
MIDDLESEX
LONDON
BERKSHIRE
WILTSHIRE
HAMPSHIRE
SURREY
KENT
SUSSEX
OXFORD
CHILTERN HILLS
COTTESWOLD HILLS
WHITE HORSE HILLS
SALISBURY PLAIN
NORTH DOWNS
SOUTH DOWNS
FOREST RIDGES
HIND HEAD
RIVER THAMES
Worcester
Evesham
Tewkesbury
Cheltenham
Gloucester
Stow on the Wold
Stroud
Cirencester
Malmesbury
Wootton Bassett
Swindon
Chippenham
Calne
Devizes
Trowbridge
Warminster
Shrewton
Tisbury
Salisbury
Stockbridge
Andover
Basingstoke
Winchester
Alton
Petersfield
Midhurst
Horsham
Guildford
Farnham
Woking
Epsom
Croydon
Reigate
Dorking
Sevenoaks
Tunbridge Wells
E. Grinstead
Crowborough
Ashford
Tenterden
Maidstone
Chatham
Gravesend
Dartford
Sheerness
Southend
Wickford
Brentwood
Romford
Epping
Ongar
Chelmsford
Maldon
Colchester
Great Dunmow
Halstead
Bishop's Stortford
Saffron Walden
Newport
Throcking
Hitchin
Royston
Haverhill
Sudbury
Newmarket
Bury St Edmunds
Cambridge
Shelford
St Neots
Sharnbrook
Bedford
Biggleswade
Ampthill
Woburn
Dunstable
Banbury
Towcester
Northampton
Daventry
Stratford on Avon
Farnborough
Brackley
Buckingham
Swerford
Steeple Aston
Winslow
Bicester
Ovingo
Woodstock
Charlbury
Witney
Oxford
Aylesbury
Wendover
Tring
Berkhampstead
St Albans
Hertford
Ware
Feldes Weir
Chesham
High Wycombe
Wellington
Abingdon
Faringdon
Lechlade
Wantage
Lambourne
Goring
Hendon
Harrow
Camden Square
Ealing
Slough
Staines
Teddington
Hampton Court
Streatham
Greenwich
Hatfield
Potters Bar
Enfield
Loughton
Watford
Mill Hill
Harrow
Reading
Hungerford
Newbury
Kingsclere
Wellington College
Hartley
Pewsey
Marlborough
Lechlade
Cirencester
Stroud
Gloucester
Tewkesbury
Evesham
Worcester
Warwick
Daventry
Northampton
Towcester
Banbury
Brackley
Buckingham
Winslow
Bicester
Oxford
Witney
Woodstock
Charlbury
Swerford
Steeple Aston
Stow on the Wold
Cheltenham
Gloucester
Malmesbury
Swindon
Wootton Bassett
Chippenham
Calne
Devizes
Trowbridge
Warminster
Shrewton
Tisbury
Salisbury
Stockbridge
Andover
Basingstoke
Winchester
Alton
Petersfield
Midhurst
Horsham
Guildford
Farnham
Woking
Epsom
Croydon
Reigate
Dorking
Sevenoaks
Tunbridge Wells
E. Grinstead
Crowborough
Ashford
Tenterden
Maidstone
Chatham
Gravesend
Dartford
Sheerness
Southend
Wickford
Brentwood
Romford
Epping
Ongar
Chelmsford
Maldon
Colchester
Great Dunmow
Halstead
Bishop's Stortford
Saffron Walden
Newport
Throcking
Hitchin
Royston
Haverhill
Sudbury
Newmarket
Bury St Edmunds
Cambridge
Shelford
St Neots
Sharnbrook
Bedford
Biggleswade
Ampthill
Woburn
Dunstable
Banbury
Towcester
Northampton
Daventry
Stratford on Avon
Farnborough
Brackley
Buckingham
Swerford
Steeple Aston
Winslow
Bicester
Oxford
Witney
Woodstock
Charlbury

THE WEATHER OF MARCH.

SOME of the most disagreeable weather we experience in these islands occurs when the country occupies a position between two areas of high barometric pressure. The intervening trough forms a prolific breeding ground for cyclonic depressions; and as the driving power (if one may so express it) of the nearest high pressure system is largely restrained by the driving power of its more distant compeer such disturbances usually move slowly, and the accompanying bad weather is consequently of a more or less lingering character.

These were the conditions prevailing during a considerable portion of last month. A large anticyclone maintained a fairly normal position over the south of the North Atlantic, but at frequent intervals there was a second high pressure system in existence, sometimes in the Icelandic region, at other times over northern Europe. In these circumstances the British Isles were exposed to numerous depressions, many of which travelled in a general easterly course over our southern districts, the Channel and the north of France. In the south the winds showed considerable variability in direction, but over the country as a whole they were more often than not from some polar quarter, and as a result the mean temperature of the month was considerably below the average.

During the earlier half the weather was changeable and wet, more especially in the western districts. Temperature was usually below the normal, but, during a brief period of south-westerly winds which prevailed at the beginning of the month, and a similar spell which occurred between the 9th and 11th, the thermometer rose slightly above 55° in many parts of England. Sharp frost was experienced, however, in Ireland and Scotland on the night of the 3rd, over England on the night of the 5th, and over the United Kingdom generally between the 13th and 15th.

After about the middle of the month the weather (contrary to rule) became colder even than in the earlier half, and between the 23rd and 26th, when an anticyclonic band extended temporarily from south-west to north-east across the United Kingdom, sharp frosts were experienced in all districts. In many parts of England the screened thermometer fell below 25°, and at some northern stations below 20°, a minimum of 11° being reported on the 25th at Balmoral. On the 26th and 27th the passage south-eastward of a deep storm system from Iceland to Scotland, and thence across the North Sea was accompanied by a general gale from the N.W.; and, on the night of the 28th-29th, when a secondary depression moved eastward along the Channel, a heavy fall of snow was experienced in the south of England. In London the flakes were of a remarkably fine texture, and although the ground was covered to the unusual depth of 7 to 10 inches, the snow, when melted, did not yield more than ·25 in. to ·30 in. of water in the gauge.

The total duration of bright sunshine for the month was below the average in all districts except the north and east of Scotland.

The total rainfall of the month exceeded twice the average over practically all England and Wales, except in the eastern and extreme northern counties. The amounts varied from about 2 inches in East Anglia to more than 5 inches over large areas in the south and Midlands, and rose to above 10 inches in the Welsh mountains and the Lake District. In Scotland the excess was not remarkable and in many areas the fall was short of the average. Less than 2 inches fell on the east coast and from 5 to 10 inches in the wettest parts of the Highlands. Ireland was wet generally, but a few scattered stations had less than the average. Less than 2 inches fell over the centre, and 5 inches was exceeded only in the extreme west.

The general rainfall expressed as a percentage of the average was :—England and Wales, 196; Scotland, 105; Ireland, 112; British Isles, 143.

In London (Camden Square) the mean temperature was 40°·5, or 1°·6 below the average. The duration of sunshine was 83·3 hours, and of rainfall 103·2, hours the latter being the highest value recorded in March in the past thirty-nine years, except in March, 1916, when it rained for 133·6 hours. Evaporation, ·66 inches.

RAINFALL TABLE FOR MARCH, 1919.

STATION.	COUNTY.	RAINFALL. Aver. 1875—1909. in.	1919. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days
Camden Square	*London*	1·70	3·62	+1·92	213	·88	19	21
Tenterden	*Kent*	1·95	3·51	+1·56	180	·70	5	20
Arundel (Patching)	*Sussex*	1·95	5·36	+3·41	275	1·14	19	19
Fordingbridge (Oaklands)	*Hampshire*	2·09	5·47	+3·38	261	1·11	19	19
Oxford (Magdalen College)	*Oxfordshire*	1·45	3·76	+2·31	259	1·01	19	22
Wellingborough (Swanspool)	*Northampn*	1·72	3·91	+2·19	228	·94	19	20
Bury St. Edmunds (Westley)	*Suffolk*	1·71	2·40	+ ·69	140	·32	7	17
Geldeston [Beccles]	*Norfolk*	1·57	1·78	+ ·21	113	·27	7	17
Polapit Tamar [Launceston]	*Devon*	2·74	5·37	+2·63	196	·68	10	23
Rousdon [Lyme Regis]	,,	2·30	4·95	+2·65	215	1·12	18	19
Stroud (Field Place)	*Gloucester*	2·01	4·37	+2·36	218	...	...	...
Church Stretton (Wolstaston)	*Shropshire*	2·19	5·29	+3·10	241	1·36	12	9
Boston	*Lincoln*	1·47	2·47	+1·00	168	·43	19	22
Worksop (Hodsock Priory)	*Nottingham*	1·70	3·59	+1·89	211	·85	11,19	15
Mickleover Manor	*Derbyshire*	1·69	5·23	+3.54	309	1·27	19	21
Congleton (Buglawton Vic.)	*Cheshire*	2·16	4·90	+2·74	227	·82	11	21
Southport (Hesketh Park)	*Lancashire*	2·11	5·31	+3·20	252	1·25	11	17
Wetherby (Ribston Hall)	*York, W.R.*	1·92	3·88	+1·96	202	1·23	19	11
Hull (Pearson Park)	,, *E.R.*	1·84	2·67	+ ·83	145	·55	11	17
Newcastle (Town Moor)	*North'land*	2·10	2·76	+ ·66	131	·53	9	18
Borrowdale (Seathwaite)	*Cumberland*	10·63	11·30	+ ·67	106	...	...	...
Cardiff (Ely)	*Glamorgan*	2·89	5·97	+3·08	207	·64	18	22
Haverfordwest	*Pembroke*	3·16	5·55	+2·39	176	1·20	18	20
Aberystwyth (Gogerddan)	*Cardigan*	3·04	8·57	+5·53	282	1·97	11	19
Llandudno	*Carnarvon*	2·13	5·75	+3·62	270	1·55	11	24
Cargen [Dumfries]	*Kirkcudbrt.*	3·33	4·83	+1·50	145	2·11	19	13
Marchmont House	*Berwick*	2·64	2·78	+ ·14	105	·44	19	18
Girvan (Pinmore)	*Ayr*	3·62	4·37	+ ·75	121	1·03	20	14
Glasgow (Queen's Park)	*Renfrew*	2·61	2·62	+ ·01	100	·65	19	10
Islay (Eallabus)	*Argyll*	3·68	5·23	+1·55	142	1·02	18	19
Mull (Quinish)	,,	4·28	4·24	— ·04	99	·76	18	21
Loch Dhu	*Perth*	6·29	5·95	— ·34	95	1·15	19, 26	13
Dundee (Eastern Necropolis)	*Forfar*	2·06	1·64	— ·42	80	·42	19	18
Braemar	*Aberdeen*	2·87	4·51	+1·64	157	1·00	27	16
Aberdeen (Cranford)	,,	2·65	2·16	— ·49	82	·47	27	20
Gordon Castle	*Moray*	2·36	2·09	— ·27	89	...	...	...
Drumnadrochit	*Inverness*	3·09	2·72	— ·37	88	·85	26	21
Fort William	,,	6·39	3·95	—2·44	62	1·22	26	19
Loch Torridon (Bendamph)	*Ross*	7·29	7·99	+ ·70	110	2·29	26	20
Dunrobin Castle	*Sutherland*	2·64	2·77	+ ·13	105	·55	26	10
Glanmire (Lota Lodge)	*Cork*	3·09	3·07	— ·02	99	·40	13	20
Killarney (District Asylum)	*Kerry*	4·51	3·71	— ·80	82	·52	28	27
Waterford (Brook Lodge)	*Waterford*	2·64	2.96	+ ·32	112	·36	3	23
Nenagh (Castle Lough)	*Tipperary*	2·99	3·29	+ ·30	110	·46	12	25
Ennistymon House	*Clare*	3·24	3.11	— ·13	96	·41	12	19
Gorey (Courtown House)	*Wexford*	2·28	2·48	+ ·20	109	·39	28	14
Abbey Leix (Blandsfort)	*Queen's Co.*	2·59	2·94	+ ·35	113	·62	4	22
Dublin (Fitz William Square)	*Dublin*	1·98	2·19	+ ·21	111	·38	18	21
Mullingar (Belvedere)	*Westmeath*	2·64	1·83	— ·81	69	·42	19	15
Crossmolina (Enniscoe)	*Mayo*	4·36	5·39	+1·03	124	·95	6	26
Cong (The Glebe)	,,	3·80	..	...	...	...	...	...
Collooney (Markree Obsy.)	*Sligo*	3·33	4·07	+ ·74	122	·66	17	20
Seaforde	*Down*	2·84	3·86	+1·02	136	1·45	18	17
Ballymena (Harryville)	*Antrim*	3·07	4·70	+1·63	153	1·22	17	22
Omagh (Edenfel)	*Tyrone*	2·98	·99	+1·01	134	.88	18	

SUPPLEMENTARY RAINFALL, MARCH, 1919.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches
II.	Warlingham, Redvers Road..	4·86	XI.	Lligwy	5·18
,,	Ramsgate	2·70	,,	Douglas, Isle of Man	4·72
,,	Hailsham	4·39	XII.	Stoneykirk, Ardwell House...	3·49
,,	Totland Bay, Aston House...	4·84	,,	Carsphairn, Shiel	6·81
,,	Stockbridge, Ashley..	4·85	,,	Langholm, Drove Road	4·95
,,	Grayshott	5·44	XIII.	Selkirk, The Hangingshaw..	4·73
,,	Upton Nervet	5·35	,,	North Berwick Reservoir.....	1·47
III.	Harrow Weald, Hill House...	3·48	,,	Edinburgh, Royal Observaty.	1·34
,,	Pitsford, Sedgebrook.....	4·11	XIV.	Biggar.....	2·24
,,	Woburn, Milton Bryant.....	...	,,	Maybole, Knockdon Farm ...	2·45
,,	Chatteris, The Priory.....	2·08	XV.	Shiskine	5·57
IV.	Elsenham, Gaunts End	2·63	,,	Ardgour House	4·81
,,	Shoeburyness	...	,,	Oban.....	3·16
,,	Colchester, Hill Ho., Lexden	2·21	,,	Holy Loch, Ardnadam	6·81
,,	Aylsham, Rippon Hall	2·04	,,	Loch Venachar	4·95
,,	Swaffham	2·26	XVI.	Glenquey	3·90
V.	Bishops Cannings	4·85	,,	Loch Rannoch, Dall	3·29
,,	Weymouth.....	4·68	,,	Blair Atholl	2·66
,,	Ashburton, Druid House.....	7·03	,,	Coupar Angus	1·90
,,	Cullompton	4·99	,,	Montrose, Sunnyside Asylum.	1·54
,,	Lynmouth, Rock House	6·01	XVII.	Balmoral	3·25
,,	Okehampton, Oaklands.....	6·44	,,	Fyvie Castle	3·13
,,	Hartland Abbey.....	3·88	,,	Keith Station	3·04
,,	St. Austell, Trevarna	5·90	XVIII.	Rothiemurchus	...
,,	North Cadbury Rectory.....	4·65	,,	Loch Quoich, Loan	10·40
VI.	Clifton, Stoke Bishop	5·70	,,	Skye, Dunvegan	6·23
,,	Ledbury, Underdown..... ...	4·61	,,	Fortrose.....	1·95
,,	Shifnal, Hatton Grange.....	4·78	,,	Glencarron Lodge	5·25
,,	Droitwich.....	3·97	XIX.	Tongue Manse	3·99
,,	Blockley, Upton Wold.....	5·42	,,	Melvich	3·46
VII.	Grantham, Saltersford.....	3·92	,,	Loch More, Achfary	7·27
,,	Louth, Westgate	3·22	XX.	Dunmanway, The Rectory ..	4·65
,,	Bawtry, Hesley Hall	3·15	,,	Mitchelstown Castle.....	2·92
,,	Derby, Midland Railway.....	4·41	,,	Gearahameen	7·50
VIII.	Nantwich, Dorfold Hall	5·28	,,	Darrynane Abbey.....	4·54
,,	Bolton, Queen's Park	7·31	,,	Clonmel, Bruce Villa	2·90
,,	Lancaster, Strathspey	4·41	,,	Roscrea, Timoney Park	2·48
IX.	Langsett Moor, Up. Midhope	5·67	,,	Broadford, Hurdlestown.....	2 96
,,	West Witton	4·87	XXI.	Enniscorthy, Ballyhyland...	3·30
,,	Scarborough, Scalby	4·94	,,	Rathnew, Clonmannon	2·21
,,	Ingleby Greenhow	4·33	,,	Hacketstown Rectory	...
,,	Mickleton	1·50	,,	Ballycumber, Moorock Lodge	1·61
X.	Bellingham, High Green Manor	2·87	,,	Balbriggan, Ardgillan	2·18
,,	Ilderton, Lilburn Cottage ...	2·47	,,	Castle Forbes Gardens.....	2·26
,,	Keswick, The Bank.....	5·03	XXII.	Ballynahinch Castle.....	3·93
,,	Orton.....	6·05	,,	Woodlawn	1·11
XI.	Llanfrechfa Grange	6·43	,,	Westport House	3·77
,,	Treherbert, Tyn-y-waun	10·90	,,	Dugort, Slievemore Hotel ...	6·07
,,	Carmarthen, The Friary	6·42	XXIII.	Enniskillen, Portora.....	2·67
,,	Fishguard, Goodwick Station.	4·12	,,	Dartrey [Cootehill]	2·76
,,	Crickhowell, Tal-y-maes.....	6·50	,,	Warrenpoint, Manor House ..	2·71
,,	Birmingham WW., Tyrmynydd	8·12	,,	Belfast, Cave Hill Road	4·29
,,	Lake Vyrnwy	7·43	,,	Glenarm Castle	3·37
,,	Llangynhafal, Plas Drâw.....	4·70	,,	Londonderry, Creggan Res...	4·68
,,	Rhiwbryfdir	11·99	,,	Milford Manse	4·06
,,	Dolgelly, Bryntirion.....	8·70	,,	Killybegs	6·54

Climatological Table for the British Empire, October, 1918.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	64·5	6	32·4	1	57·2	43·8	...	90	113·6	28·2	1·23	16	8·1
Malta	86·0	1	57·0	10	73·9	65·7	62·5	82	133·5	53·5	4·28	9	2·6
Lagos	90·0	24	69·4	8	86·1	74·1	73·4	77	162·4	66·0	4·11	14	7·2
Cape Town	83·9	27	40·9	4	69·9	54·1	53·4	73	...	...	1·73	10	5·8
Johannesburg	83·1	19	45·2	15	73·3	54·4	49·9	68	...	44·0	4·90	16	4·8
Mauritius	85·0	30	60·0	13	80·0	65·0	62·0	71	...	54·0	1·36	18	6·1
Bloemfontein	84·1	11	39·0	9	77·2	51·2	50·6	62	..	...	2·39	6	4·3
Calcutta...	93·9	4	69·7	23	89·6	74·3	72·0	74	...	62·2	·29	2	3·0
Madras	96·3	12	68·6	26	92·1	75·0	70·9	70	165·5	65·4	4·34	2	3·2
Colombo, Ceylon ...	87·8	29	71·8	6, 10	85·9	74·6	73·4	83	160·1	67·8	14·76	19	7·6
Hongkong	88·2	23	67·6	26	81·6	72·5	64·2	66	...	...	·05	1	4·2
Sydney	91·6	30	42·3	3	72·0	53·4	48·7	56	141·6	47·7	·77	10	4·2
Melbourne	79·2	19	32·2	3	65·0	47·4	44·6	63	134·0	24·8	2·35	...	6·9
Adelaide	87·8	29	37·9	5	70·2	51·2	47·6	60	144·0	27·8	2·59	11	5·5
Perth	88·0	14	43·2	3	68·6	52·8	50·9	70	150·2	35·0	2·90	15	5·0
Coolgardie	97·0	15	39·8	7	77·7	51·1	43·7	42	155·0	36·0	·16	1	3·5
Brisbane	100·1	28	53·4	3	83·7	60·9	56·4	56	157·4	49·0	1·14	7	3·8
Hobart, Tasmania ..	74·5	11	34·1	3	58·6	44·0	39·9	61	138·3	29 1	3·13	22	6·8
Wellington	69·6	9	38·2	12	60·3	49·4	46·7	75	141·0	26·8	6·48	17	6·6
Jamaica, Kingston ...	92·3	12	71·6	31	88·5	73·7	72·4	82	...	...	2·17	11	7·4
Grenada	...	...	...	...	...	...	...	...	...	...	...		...
Toronto	73·3	10	30·0	15	60·0	42·8	44·4	88	122·6	25·0	2·84	13	5·0
Fredericton	66·8	13	21·0	20	56·8	36·1	39·2	77	...	...	4·80	11	5·5
St. John, N.B. ...	64·2	10	31·7	19	53·3	40·8	41·2	80	120·3	26·0	6·56	14	6·2
Victoria, B.C.	66·5	1	40·3	14	56·4	46·2	47·0	89	121·5	34·8	4·13	16	6·7

Johannesburg.—Bright sunshine 237·7 hours.

COLOMBO, CEYLON.—Mean temp. 80°·2, or 0°·1 above, dew point 0°·3 below, and R 1·33 in. above, averages. Mean hourly velocity of wind 3·2 miles. TS on 9 days.

HONGKONG.—Mean temp. 76°·4. Bright sunshine 234·5 hours. Mean hourly velocity of wind 10·8 miles.

Melbourne.—Mean temp. 1°·4 below, and R ·26 in. below, averages.

Adelaide.—Mean temp. 1°·2 below, and R ·87 in. above, averages.

Coolgardie.—Temp. 0°·8 below, and R about ·50 in. below, averages.

Brisbane.—Temp. above, and R below, averages. Highest shade maximum for October since 1887 with one exception.

Hobart.—Temp. below, and R ·89 in. above, averages.

Wellington.—A wet month. Mean temp. 0°·6 above, and R 2·28 in. above, averages. Bright sunshine, 160·2 hours. Frost on 2 days. TS on 2 days.

Symons's
Meteorological Magazine.

No. 640. MAY, 1919. Vol. LIV.

WEATHER FORECASTS FOR AIR AND SEA.

The Times announces over the signature of Admiral J. F. Parry, Hydrographer of the Navy, that in view of the extent to which aircraft will have to rely for information as to weather conditions upon data from ships at sea, the Admiralty have issued a notice to mariners making arrangements for a new and comprehensive scheme. This involves the collection by wireless of meteorological data from ships in all parts of the world and at the same time the organisation of free transmission of weather bulletins from a sufficient number of wireless stations to admit of ships being constantly supplied with reliable weather reports and forecasts wherever they may be.

Six or eight observation stations are being established in the North-eastern Atlantic and ships are asked to supply to them information regularly at 1 a.m., 7 a.m. and 1 p.m. (G.M.T.) each day, besides sending additional messages when required to do so from areas in which peculiar conditions obtain. All ships fitted with the necessary apparatus will be called upon to assist, but on receipt of an intimation that another ship in the vicinity is reporting no message will be sent. This avoids not only duplication, but interference, a very necessary precaution with wireless telegrams. The technical difficulties of securing priority of transmission are considerable, but they can be overcome by co-operation. Should it prove impossible to decipher long-range telegrams, international "silent periods" might possibly have to be resorted to, but it is hoped that this may be avoided. Earnest endeavours are being made to secure international agreement in the matter of codes, signals, times and methods in general.

The organization which has been undertaken by the Meteorological Office involves the collection of observations by code messages, at Valencia and Malin Head. The data will then be transmitted to

London by wireless for co-ordination. Wireless bulletins will be issued, and may include either a weather report, that is an official statement of existing conditions in some particular area, or a weather forecast of the probable weather conditions, or both. A list is given of 42 wireless transmission stations in all parts of the world from which bulletins will be issued regularly. There are in addition certain other stations which will be available for the supply of information on demand. The British stations proposed are Poldhu, in Cornwall, and Cleethorpes, in Lincolnshire, both of which will shortly be ready for the purpose.

Quite apart from the enormous advance in the economic utilization of modern weather forecasting, the scheme holds almost boundless possibilities for the development of scientific meteorology, and we look forward with the highest hopes to the fruition of so important a scheme of co-operative effort.

ROYAL METEOROLOGICAL SOCIETY.

A MEETING of this Society was held on April 16th at 70, Victoria Street, S.W., Mr. F. J. W. Whipple, M.A., Vice-President, in the Chair.

Mr. A. A. Barnes, C.E., read a paper entitled, "Rainfall in England: the true long-average as deduced from symmetry." It had been usual to assume that the average annual rainfall during any period of 35 years can be adopted for obtaining the "long average" at any rain gauge, but the author considered that the fluctuations which occurred between such averages for various thirty-five year periods tended to show that the basis was somewhat uncertain. By an exhaustive analysis by mean of plotting the residual mass curves of the annual totals of thirty-eight rain gauges in England during 1856-1917, the author proved that variations of as much as 5 per cent. on each side of the mean were possible when dealing with successive thirty-five year periods. From the same records it was shown that far greater consistency in the value of the average can be obtained by taking periods symmetrical about the end of the year 1886. By means of tables and diagrams the author showed that that date was a critical one in regard to rainfall in England, and that as a rule the years before were relatively wetter than years subsequent to it. Hence the balancing of the earlier wet years by the later dry years established the principle of symmetry about that date. It was shown that by this method the maximum departure from normal resulting from taking each of the fifteen long periods symmetrical to the end of the year 1886 did not exceed 1 per cent. in the case of any of the thirty-eight gauges.

Mr. C. E. P. Brooks, M.Sc., read a paper entitled, "The Secular Variation of Rainfall." In order to obtain a measure of the secular variation of rainfall during the past 30 to 50 years, correlation coefficients were worked out between the annual rainfall at each station and "time," the measure of the latter being the number of years before or after the middle year of the series. This was done for 162 stations distributed over the globe, and the results were plotted on a map. The map showed that the greater part of the world was divided into a few definite regions of wide extent, in each of which the rainfall had been either increasing or decreasing. The most important area of increasing rainfall was temperate Eurasia (except the western sea-board); other areas were south-east South America and the south of Australia. Areas of decrease were the tropical regions as a whole, South Africa and the west coast of Europe. It was noted that the number of sunspots and also of solar prominences during the period in question had been decreasing. For a few stations records of longer period were dealt with, giving indications that the results obtained were due to a periodicity of upwards of 50 years.

A discussion followed in which Mr. F. J. W. Whipple thanked the authors for their valuable papers and hoped that Mr. Barnes would extend his investigation to include Scotland and Ireland. Mr. Carle Salter suggested that it would probably be found that the shorter phased rainfall fluctuations were local, the longer ones less so, and the longest possibly world-wide, as Mr. Brooks contended. Mr. R. H. Hooker and Mr. E. H. Chapman considered that the low correlation coefficients and the irregular nature of distribution in Mr. Brooks's results were highly inconclusive and well within the range of accidental error. Mr. H. E. Carter, who had examined some records outside the area considered by Mr. Barnes, said that the symmetry about the end of 1886 apparently held good in the Scottish Highlands, but did not exist at the two Irish stations considered. In a written communication, Dr. H. R. Mill called attention to a possible wave-length in the residual mass curves of about sixty years over the north of England and about forty years over the south, and suggested that it might be found that a symmetry existed about the minima of the curves similar to that which Mr. Barnes had proved to exist about the maxima. Mr. J. Baxendell wrote that the 1886 discontinuity found by Mr. Barnes probably arose from the synchronization of several periods of different length.

The following candidates were ballotted for and elected Fellows of the Society:—T. J. Arnold, Surg.-Lt. R. A. D. J. Bernhardt, R.N.V.R., G. T. Osborn, L. F. Richardson, A.M.I.E.E., G. L. Smith, C. A. Spon, Lieut. D. N. Stewart, R.A.F., R. L. Waterfield, and C. J. Wyke.

Correspondence.

To the Editor of Symons's Meteorological Magazine

DEW PONDS.

In your note on Dew Pond construction in the February number, you describe Mr. G. Hubbard's experiment as being extremely interesting and successful. But, judging from the report in *The Times*, he only showed over again what has perhaps been known in India for centuries that a body placed in a pit and thermally isolated from the earth will fall to a lower temperature on a still clear night than surrounding bodies not isolated. He has neither shown that the surface of a "dew pond" will fall so low nor that dew will condense upon such a surface.

My immediate object in writing, however, is in reference to Mr. Hubbard's extraordinary statement that there are "natural dew ponds in the Colesberg district of Cape Colony, where in the absence of springs, streams, and rains, ponds have a higher water level in the morning than they had in the previous evening" (*Times* Report). Seeing that this statement is at variance with the common assertion (baseless, of course), that evaporation in South Africa goes on more rapidly by night than by day, and just to ascertain whether there was any sort of foundation in rumour or in imagination or otherwise, for what Mr. Hubbard is reported to have said, I wrote to the Resident Magistrate at Colesberg, quoting *The Times* Report and asking whether the claim had ever been made locally, to his knowledge, that the water in the ponds in his district increases during the night, and if so how the measurements were made. His reply is short and to the point :—

> "I have the honour to inform you that from information received it would appear that there is no basis of truth in the statement made by Mr. G. Hubbard."

The rain maker has had a long and a flourishing career. Is he going to be supplanted at last by the dew maker?

Kimberley, South Africa, March 30th, 1919. J. R. SUTTON.

RAINFALL OF JANUARY TO APRIL.

I have to report 14·07 in. of rain for the past four months, the wettest January to April since 1877, when 14·23 in. fell. This was also the first year since then with the rainfall of all four months above the average.

January and February were wetter in 1900 and 1915, February and March much wetter in 1914 and 1916, and March in 1909 and 1912. But April had over 3 inches before only in 1871, 1878, 1879 and 1907, the wettest being 3·81 in., in 1878. J. ELLIS MACE.

View Tower, Tenterden, May 1st, 1919.

MAMMATO-CUMULUS.

METEOROLOGICAL writers appear to be almost unanimous upon at least one point and that is the "rare occurrence and fleeting duration of the mammilated or festooned appearance of cloud usually designated by the prefix "Mammato."

My own experience as an amateur Observer of cloud phenomena convinces me that the occurrence is by no means so rare as they might lead us to suppose, and that the modification in question is not confined exclusively to cumuliform clouds is shown by the fact that I personally recorded during the years 1911-1913 inclusive 101 occasions upon which mammato effects were observed and that these were distributed over six different types of cloud.

The descriptions usually met with are not very lucid and some confusion on the subject evidently exists in the minds of meteorologists, unless it is that their powers of observation are at fault, for most authors who consider it worth their while to discuss cloud forms at any length (and they are few), maintain the idea of the rarity of the phenomenon, whilst Sir J. W. Moore, in his "Meteorology" testifies to having often seen it and W. M. Davis in "Elementary Meteorology" conveys the impression that there is nothing unusual in the occurrence.

The cloud effects recorded by me as "Mammato" are in agreement with those indicated in the photographic illustrations under that head in Capt. Cave's "The Forms of Clouds," in the "Meteorological Glossary," and in Dr. Lockyer's article in Cassell's "Nature Book," respectively.

I have already fourteen instances recorded during the first four months of this year, and the face of the sky here during the evening of Friday, 25th April, was among the most ominous and threatening I have ever seen. The Mammato effect could scarcely have failed to make a vivid impression upon the mind of the most casual observer.

It is not my intention to discuss here the general significance of this phenomenon, but it is not without interest to record that we experienced a respectable thunderstorm within twenty-four hours and a prolonged and destructive blizzard on the second day, neither of which appear to have been anticipated in the forecasts issued to the Press.

On this occasion at least the sequence of severe weather more than justified the conclusion of the late Rev. W. Clement Ley, viz., that "the cloud seems to be one indicating the very worst possible description of weather," and of that other great student of clouds, Mr. A. W. Clayden, who says, that "it is an indication of very disturbed conditions."

A. S. MARTIN-SMITH.

71, Wood Street, Barnet, April 28th, 1919.

SNOWFALL OF APRIL 28th.

RAIN here began about 9.30 a.m. (G.M.T.), gradually giving a steady downpour of rain and sleet. Before 4 p.m. it almost ceased. About 4.10 an ashen mist supervened, with fine snow, from north-west. The rain began with wind from north-west, but it backed slowly to south-east by about 1 p.m. and remained there until 4 p.m. By 4.30 it was snowing fast. By 4.45 p.m. a dense yellow fog made it almost dark—evidently London smoke rolled back by the sudden wind reversal. A paragraph in the *Westminster Gazette* of the 29th indicates a closely parallel reversal at Edinburgh just four hours previously.

Snow fell nearly all night and at 6 a.m. several measurements showed a depth of 8 inches or over. Probably fully 10 inches fell, allowing for what certainly melted. The 8 inches melted out to ·82 in.

J. EDMUND CLARK.

Asgarth, Riddlesdown Road, Purley, Surrey, April 28th, 1919.

SNOW and sleet began at 9.30 a.m. yesterday and fell lightly until the afternoon, mist and yellow fog at 4 p.m. Snow fell heavily from 7 p.m. and all night. I measured 1·71 in. at 9 a.m. this morning for the previous twenty-four hours. The depth of the undrifted snow was 8½ inches. The ground was still covered with snow at 3.30 p.m. The above are local mean times and not summer time.

E. R. TAYLOR.

Can Hatch, Burgh Heath, Tadworth, Surrey April 28th, 1919.

UNUSUAL OPTICAL PHENOMENON.

A RATHER unusual phenomenon was noticed here on Wednesday, April 23rd, at 17 h. 30 m. The sky was overcast with cirro-nebula, which was only discernible by its slight milkiness and which was evidently of no great thickness. An arc of which the colours were almost as bright as those of a rainbow, appeared not far from the zenith. I at first thought it was an arc of contact to a 46° halo, the red being on the outside, but estimated its distance from the sun at from 55° to 60°. Even supposing that I over-estimated this, it does not account for the total absence of halos, for the production of which the conditions seemed extremely favourable. I should add that there were some thin alto-cumulus clouds to the north of the arc moving from the north or north-west. I should be glad of some explanation of this.

F. HEYWOOD.

34, Longford Avenue, Stretford, Manchester, May 1st, 1919.

SNOW FOLLOWING FINE WEATHER.

ACTING on Mr. Dines's suggestion, I sent him further dates, showing the same sequence, and in reply he says : "The pressure conditions on these occasions were of a very variable type, so that the simple explanation which I suggested will not go far to explain the phenomena."

Corroboration of my note followed five days after. March 10th was a warm mild day (though not sunny) with a maximum temperature of 55° ; on March 12th the wind shifted to the north, and there was a heavy snowstorm. A sudden rise of temperature with a soft warm atmosphere is frequently a signal for a cold snap. This was shown on April 18th and 19th, when there was a sudden jump to a maximum on both days of 66°. A cold north-east wind immediately followed and a minimum of 31° occurred on the 21st and 22nd.

Dollarward House, Cirencester, May 1st, 1919. C. P. HOOKER.

METEOROLOGICAL NEWS AND NOTES.

THE ROYAL METEOROLOGICAL SOCIETY, it was announced at the meeting on April 16th, contemplate holding a special summer meeting at Kew Observatory, Richmond, by the invitation of the Director of the Meteorological Office. The date has been provisionally fixed for Wednesday, July 2nd.

METEOROLOGICAL OBSERVATIONS AT LU-KIA-PANG, CHINA, FOR 1918.

By REV. J. DE MOIDREY S.J.

(*concluded from page 29*).

VI.—*Rainfall.*

	(*a*). INTENSITY. Days with mm. 0·1—0·9	1·0—2·9	3·0—4·9	5·0—9·9	10·0—19·9	20·0—39·9	40·0—59·9	60·0 & over	DAYS WITH Rain.	Snow.	Total.
Jan.	—	—	—	—	—	—	—	—	—	—	—
Feb.	4	5	2	—	—	—	—	—	10	1	11
Mar.	10	2	—	1	5	1	—	—	15	—	15
April	9	1	2	5	1	1	—	—	14	—	14
May	6	3	2	2	—	—	—	—	10	—	10
June	3	4	3	1	1	1	2	—	14	—	14
July	5	—	1	1	2	2	—	1	12	—	12
Aug.	2	1	1	3	1	1	—	—	9	—	9
Sept.	3	4	2	—	1	1	—	—	11	—	11
Oct.	4	2	—	—	1	—	1	—	5	—	5
Nov.	5	3	1	1	5	1	—	—	13	—	13
Dec.	3	2	2	5	5	2	—	—	19	—	19
Year	54	27	16	19	22	10	3	1	132	1	133

VI.—(*con.*)

(*b.*) *Total Rainfall. Millimetres.*

	8 p.m. —8 a.m.	8 a.m. —8 p.m.	Total.
Jan. ..	—	—	—
Feb. ..	8·0	10·2	18·2
Mar. ..	43·5	51·9	95·4
April ..	55·0	30·3	85·3
May ..	21·7	14·8	36·5
June ..	**127·8**	**122·1**	**249·9**
July ..	74·0	88·7	162·7
Aug. ..	41·7	79·3	121·0
Sept. ..	5·5	63·8	69·3
Oct. ..	55·1	16·9	72·0
Nov. ..	51·8	71·7	123·5
Dec. ..	74·8	89·3	164·1
Year ..	558·9	639·0	1197·9

(*c.*) *Rainless Periods of 10 days or more, excluding dew.*

Began.	Ended.	Lasted.
Dec. 15, 1917	Feb. 4	52 days.
Feb. 16	Feb. 26	11 ,,
July 20	Aug. 10	22 ,,
Sept. 29	Oct. 20	22 ,,
Dec. 27	Jan. 7	12 ,,

VIII.

Mean Duration of Bright Sunshine. Hours.

	Fore-noon.	After-noon.	Total.	Per-centage of possible	Mean amount of Cloud.
Jan. ..	3·4	2·8	6·2	**60**	0·4
Feb. ..	2·2	1·7	3·9	35	0·6
Mar. ..	2·5	1·9	4·4	37	0·6
April ..	2·0	1·9	3·9	30	0·7
May ..	3·5	3·1	6·6	48	0·5
June ..	2·2	1·9	4·1	29	0·7
July ..	3·7	3·5	7·2	51	0·5
Aug. ..	4·1	3·9	8·0	**60**	0·4
Sept. ..	3·4	3·4	6·8	55	0·4
Oct. ..	3·5	3·0	6·5	57	0·4
Nov. ..	1·7	1·7	3·4	33	0·7
Dec. ..	1·2	0·9	2·1	*20*	0·8
Year ..	2·8	2·5	5·3	43	0·6

VII.—*Wind.* (*a*)

Mean Velocity at 8 a.m., 2 p.m. and 8 p.m. Metres per second.

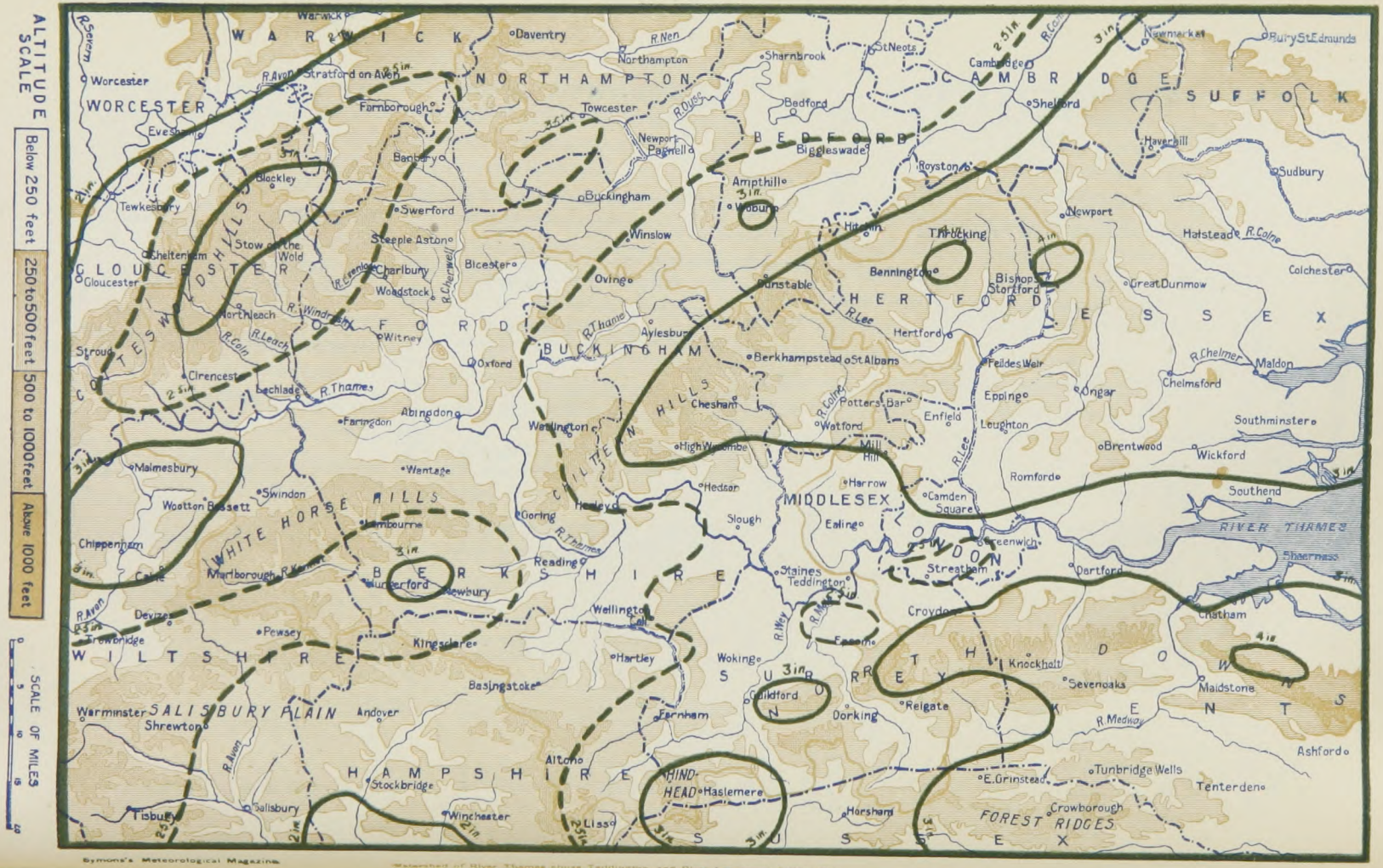
	Mean.	Min.	Max.
Jan. ..	**4·0**	1·2	6·9
Feb. ..	3·8	2·2	7·8
Mar. ..	3·7	1·9	8·2
April ..	3·7	2·1	8·8
May ..	3·3	1·6	7·0
June ..	3·1	0·8	6·1
July ..	3·4	0·7	**9·4**
Aug. ..	—	—	—
Sept. ..	—	—	—
Oct. ..	3·1	*0·5*	6·3
Nov. ..	*2·9*	0·7	6·1
Dec. ..	3·8	1·0	6·0
Year ..	3·5	0·5	9·4

VII.—*Wind. (b.) Direction. Percentage Frequency.*

	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.	Vari-able.
Jan.	17	9	*1*	7	3	8	9	**32**	11	3
Feb.	**28**	9	14	11	7	6	*4*	19	1	0
Mar.	13	**25**	18	16	4	5	*2*	16	1	0
April ..	13	16	19	**20**	9	7	*5*	9	0	1
May	*4*	*4*	15	**33**	11	9	5	16	3	0
June	3	*2*	10	**33**	25	10	4	4	6	1
July	7	7	16	**37**	10	*2*	8	6	5	0
Aug.	—	—	—	—	—	—	—	—	—	—
Sept. ..	*1*	9	18	**44**	20	3	*1*	2	0	0
Oct.	**23**	14	15	10	7	*4*	10	14	2	1
Nov.	21	18	11	7	6	*2*	6	**24**	3	1
Dec.	**27**	24	10	3	4	*2*	4	24	2	0
Year	14	12	13	**20**	10	*5*	*5*	15	3	1

The anemometer was repaired in August.

THAMES VALLEY RAINFALL APRIL. 1919.



THE WEATHER OF APRIL.

THE weather of April was of the proverbially changeable character, and, for the fourth month in succession, the mean temperature over the country generally was appreciably below the average. The deficiency of warmth last month did not, however, extend to the whole country. Along the east coasts of Great Britain the mean values were quite equal to the normal, and in a few places, *e.g.*, Aberdeen and Tynemouth, the mean of all the daily maxima was distinctly high for the time of year.

At the opening of the month when an anticyclone extended temporarily over the country from the Atlantic, sharp frost occurred in most districts, the temperatures recorded on the 1st being in some places the lowest of the whole month. After the 3rd, and for a period of nearly ten days, the winds were affected by cyclonic disturbances moving along far to the northward of these islands, and were, therefore, mainly W. or S.W., with temperatures rather above the normal. On the 7th the thermometer in the south-east of England rose slightly above 60°, and on the 11th similar readings were recorded in parts of the United Kingdom. Between the 14th and 16th the weather was influenced by a deep depression whose centre moved eastward across the northern parts of Ireland and England, the wind in its rear increasing to a gale from the N.W on many portions of our western and northern coasts. The departure of the storm system was followed by the extension of a large anticyclone from the Atlantic, and on the 18th and 19th, when a wave of warm air from the south-westward was accompanied by much sunshine, the thermometer rose to between 65° and 70° in many parts of Great Britain, and slightly exceeded 70° in a few isolated places. On the 20th a shift of wind to the N. occasioned a sudden drop in temperature, the maximum readings in the south-east of England being about 15° lower than those of the previous day. Sharp frost was experienced on the nights of the 20th and 21st, the sheltered thermometer falling below 25° in several districts, and touching 22° at Rhayader.

The cold weather continued until practically the end of the month, and between the 26th and 28th, the conditions were, for so advanced a period in the season, more inclement than in any recent year, with the exception of 1908, when a touch of winter was also experienced shortly after Easter. The disturbing influences last month were supplied by a large depression which moved southward across northern Europe and by small secondary systems which were developed over Great Britain and the North Sea. On the 27th light west winds and steady rain were followed by northerly gales and a heavy fall of snow, the depth in several parts of London and the home counties amounting to between 10 and 12 inches. On the same night a sharp frost was experienced, the thermometer falling to at least 27° in many places and reaching 22° at West Linton.

The distribution of rainfall was irregular. Less than 2 inches fell along the east coast of Great Britain from the Firth of Tay to East Anglia and along the south coast east of Selsey. The area below 2 inches also embraced the greater part of the Midlands and the north of England except the Lake District, and the Pennines. A large triangular area with more than 3 inches, including patches above 4 inches, lay to the north and east of London. Small areas in the Welsh mountains and the Lake District had more than 5 inches of rain, and in Scotland there was a considerable area west of the Caledonian Canal with more than 10 inches. In Ireland the rainfall was generally light, 2 inches being exceeded only at elevated stations. The general rainfall expressed as a percentage of the average was :—England and Wales, 124; Scotland, 138; Ireland, 72· British Isles, 113.

In London (Camden Square) the mean temperature was 45°·9, or 2°·2 below the average. The duration of sunshine was 100°·1 hours and of rainfall, 57·7 hours. It was the wettest April in 62 years' record, with the exception of April, 1878, when 4·97 in. of rain fell. The total rainfall of the first four months of 1919 was 94 per cent. above the average. Evaporation, 1·06 in.

RAINFALL TABLE FOR APRIL, 1919.

STATION.	COUNTY.	RAINFALL.						
		Aver. 1875—1909. in.	1919. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days
Camden Square	*London*	1·74	3·93	+2·19	226	1·59	27	18
Tenterden	*Kent*	1·77	3·33	+1·56	188	·89	27	13
Arundel (Patching)	*Sussex*	1·82	2·29	+ ·47	126	·58	27	11
Fordingbridge (Oaklands)	*Hampshire*	1·92	2·34	+ ·42	122	·94	13	12
Oxford (Magdalen College)	*Oxfordshire*	1·67	2·21	+ ·54	132	·83	27	16
Wellingborough (Swanspool)	*Northampn*	1·78	1·82	+ ·04	102	·64	27	16
Bury St. Edmunds (Westley)	*Suffolk*	1·62	3·56	+1·94	220	1·08	27	17
Geldeston [Beccles]	*Norfolk*	1·55	1·80	+ ·25	116	·28	15	17
Polapit Tamar [Launceston]	*Devon*	2·34	3·19	+ ·85	136	·73	14	17
Rousdon [Lyme Regis]	,,	2·39	2·28	— ·11	95	·46	14	14
Ross (Birchlea)	*Herefordshr.*	2·09	1·60	— ·49	77	·50	27	15
Church Stretton (Wolstaston)	*Shropshire*	2·20	1·73	— ·47	79	·47	15	9
Boston	*Lincoln*	1·57	2·20	+ ·63	140	·55	27	18
Worksop (Hodsock Priory)	*Nottingham*	1·62	1·70	+ ·08	105	·31	27	17
Mickleover Manor	*Derbyshire*	1·77	1·40	— ·37	79	·41	27	16
Congleton (Buglawton Vic.)	*Cheshire*	1·86	1·83	— ·03	98	·29	27	19
Southport (Hesketh Park)	*Lancashire*	1·84	1·37	— ·47	74	·22	13, 14	18
Wetherby (Ribston Hall)	*York, W.R.*	1·85	1·19	— ·66	64	·27	27	6
Hull (Pearson Park)	,, *E.R.*	1·69	1·75	+ ·06	104	·82	27	13
Newcastle (Town Moor)	*North'land*	1·84	1·79	— ·05	97	·33	14	16
Borrowdale (Seathwaite)	*Cumberland*	6·91	12·09	+5·18	175	...	...	...
Cardiff (Ely)	*Glamorgan*	2·50	2·13	— ·37	85	·58	13	20
Haverfordwest	*Pembroke*	2·82	3·18	+ ·36	113	·65	28	14
Aberystwyth (Gogerddan)	*Cardigan*	2·48	3·77	+1·29	152	·73	26	16
Llandudno	*Carnarvon*	1·79	1·97	+ ·18	110	·30	26	18
Cargen [Dumfries]	*Kirkcudbrt.*	2·50	2·20	— ·30	88	·65	13	17
Marchmont House	*Berwick*	2·28	1·45	— ·83	64	·41	27	9
Girvan (Pinmore)	*Ayr*	2·81	2·44	— ·37	87	·45	15	21
Glasgow (Queen's Park)	*Renfrew*	1·86	1·14	— ·72	61	·26	10	14
Islay (Eallabus)	*Argyll*	2·64	3·73	+1·09	141	·80	7	18
Mull (Quinish)	,,	2·98	3·92	+ ·94	131	·80	10	25
Loch Dhu	*Perth*	4·38	4·20	— ·18	96	·85	10	19
Dundee (Eastern Necropolis)	*Forfar*	1·93	2·02	+ ·09	105	·59	14	13
Braemar	*Aberdeen*	2·30	2·16	— ·14	94	·82	15	9
Aberdeen (Cranford)	,,	2·23	3·16	+ ·93	142	·81	14	17
Gordon Castle	*Moray*	1·74	3·08	+1·34	177	...	...	...
Drumnadrochit	*Inverness*	1·85	3·99	+2·14	215	·70	25	23
Fort William	,,	3·65	7·77	+4·12	213	2·57	10	25
Loch Torridon (Bendamph)	*Ross*	4·70	10·84	+6·14	231	2·03	10	25
Dunrobin Castle	*Sutherland*	2·02	2·70	+ ·68	134	·50	27	17
Glanmire (Lota Lodge)	*Cork*	3·23	1·25	—1·98	39	·43	14	14
Killarney (District Asylum)	*Kerry*	3·46	2·98	— ·48	86	·82	14	25
Waterford (Brook Lodge)	*Waterford*	2·68	1·13	—1·55	42	·25	13	12
Nenagh (Castle Lough)	*Tipperary*	2·54	1·65	— ·89	65	·38	13	20
Ennistymon House	*Clare*	2·81	1·78	—1·03	63	·27	26	20
Gorey (Courtown House)	*Wexford*	2·37	1·46	— ·91	62	·26	3	14
Abbey Leix (Blandsfort)	*Queen's Co.*	2·54	1·45	—1·09	57	·31	14	16
Dublin (Fitz William Square)	*Dublin*	2·03	·90	—1·13	44	·22	26	17
Mullingar (Belvedere)	*Westmeath*	2·37	1·77	— ·60	75	·35	12	14
Crossmolina (Enniscoe)	*Mayo*	3·13	3·68	+ ·55	118	·39	9, 26	24
Cong (The Glebe)	,,	...	..	...	...	...	...	...
Collooney (Markree Obsy.)	*Sligo*	2·52	3·10	+ ·58	123	·38	26	25
Seaforde	*Down*	2·76	1·46	—1·30	53	·56	13	13
Ballymena (Harryville)	*Antrim*	2·57	2·32	— ·25	90	·39	13	20
Omagh (Edenfel)	*Tyrone*	2·50	2·10	— ·40	84	·26	25	24

SUPPLEMENTARY RAINFALL, APRIL, 1919.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches
II.	Sevenoaks, Speldhurst Av....	3·14	XI.	Lligwy	1·79
,,	Ramsgate	2·66	,,	Douglas, Isle of Man	2·31
,,	Hailsham	2·90	XII.	Stoneykirk, Ardwell House...	2·08
,,	Totland Bay, Aston House...	1·37	,,	Carsphairn, Shiel.....	4·29
,,	Stockbridge, Ashley..	2·12	,,	Langholm, Drove Road	3·10
,,	Grayshott	3·07	XIII.	Selkirk, The Hangingshaw..	3·01
,,	Upton Nervet	2·15	,,	North Berwick Reservoir.....	2·27
III.	Harrow Weald, Hill House...	2·76	,,	Edinburgh, Royal Observaty.	3·03
,,	Pitsford, Sedgebrook....	1·77	XIV.	Biggar.....	4·09
,,	Woburn, Milton Bryant.....	3·11	,,	Maybole, Knockdon Farm ...	2·01
,,	Chatteris, The Priory..... ...	2·18	XV.	Shiskine	2·79
IV.	Elsenham, Gaunts End	3·65	,,	Ardgour House	12·63
,,	Rayleigh	...	,,	Oban.....	3·88
,,	Colchester, Hill Ho., Lexden	3·34	,,	Holy Loch, Ardnadam.....	3·97
,,	Aylsham, Rippon Hall.... ..	2·19	,,	Loch Venachar.....	2·70
,,	Swaffham	1·87	XVI.	Glenquey	2·90
V.	Bishops Cannings	2·45	,,	Loch Rannoch, Dall	2·03
,,	Weymouth.....	1·43	,,	Blair Atholl	1·49
,,	Ashburton, Druid House.....	1·71	,,	Coupar Angus	1·59
,,	Cullompton	2·60	,,	Montrose, Sunnyside Asylum.	3·15
,,	Lynmouth, Rock House	2·86	XVII.	Balmoral	3·28
,,	Okehampton, Oaklands... ...	4·02	,,	Fyvie Castle	2·47
,,	Hartland Abbey.....	1·96	,,	Keith Station	4·77
,,	St. Austell, Trevarna	4·10	XVIII.	Rothiemurchus	3·69
,,	North Cadbury Rectory.....	2·35	,,	Loch Quoich, Loan	26·80
VI.	Clifton, Stoke Bishop	2·21	,,	Skye, Dunvegan	6·41
,,	Ledbury, Underdown..... ...	1·83	,,	Fortrose.....	3·25
,,	Shifnal, Hatton Grange.....	2·05	,,	Glencarron Lodge	11·43
,,	Droitwich.....	1·90	XIX.	Tongue Manse	4·32
,,	Blockley, Upton Wold.....	3·15	,,	Melvich	2·92
VII.	Grantham, Saltersford.....	1·87	,,	Loch More, Achfary	14·42
,,	Louth, Westgate	1·91	XX.	Dunmanway, The Rectory ..	3·02
,,	Bawtry, Hesley Hall	1·55	,,	Mitchelstown Castle.....	1·61
,,	Derby, Midland Railway.....	1·20	,,	Gearahameen	6·50
VIII.	Nantwich, Dorfold Hall	2·13	,,	Darrynane Abbey.....	2·60
,,	Bolton, Queen's Park	3·11	,,	Clonmel, Bruce Villa	1·63
,,	Lancaster, Strathspey	1·74	,,	Roscrea, Timoney Park	1·61
IX.	Langsett Moor, Up. Midhope	1·60	,,	Broadford, Hurdlestown.....	1·83
,,	West Witton	1·86	XXI.	Ennisoorthy, Ballyhyland...	1·96
,,	Scarborough, Scalby	2·13	,,	Rathnew, Clonmannon	1·16
,,	Ingleby Greenhow	2·20	,,	Hacketstown Rectory	2·45
,,	Mickleton	...	,,	Ballycumber, Moorock Lodge	1·19
X.	Bellingham, High Green Manor	2·22	,,	Balbriggan, Ardgillan	1·25
,,	Ilderton, Lilburn Cottage ...	1·85	,,	Castle Forbes Gardens.....	1·78
,,	Keswick, The Bank.....	3·34	XXII.	Ballynahinch Castle.....	3·14
,,	Orton.....	2·95	,,	Woodlawn	·60
XI.	Llanfrechfa Grange	1·84	,,	Westport House	2·74
,,	Treherbert, Tyn-y-waun	4·57	,,	Dugort, Slievemore Hotel ...	6·03
,,	Carmarthen, The Friary	2·05	XXIII.	Enniskillen, Portora.....	1·89
,,	Fishguard, Goodwick Station.	1·71	,,	Dartrey [Cootehill]	...
,,	Crickhowell, Tal-y-maes.....	3·30	,,	Warrenpoint, Manor House ..	1·18
,,	Birmingham WW., Tyrmynydd	3·90	,,	Belfast, Cave Hill Road	1·55
,,	Lake Vyrnwy	3·57	,,	Glenarm Castle	2·02
,,	Llangynhafal, Plas Drâw.....	2·65	,,	Londonderry, Creggan Res...	3·15
,,	Rhiwbryfdir	7·67	,,	Milford Manse	2·87
,,	Dolgelly, Bryntirion.....	4·92	,,	Killybegs	...

ERRATA.—Plas Drâw, 4·70 should be 6·70 in March.

Climatological Table for the British Empire, November, 1918.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	57·8	1	28·5	9	49·1	37·1	40·6	91	60·5	24·6	2·21	16	7·7
Malta	77·0	9	52·0	30	67·3	58·9	...	85	121·5	43·0	4·67	14	7·5
Lagos	98·3	7	70·0	4	89·2	76·0	75·2	76	161·3	67·0	2·05	7	6·1
Cape Town	94·0	3	44·8	19	74·3	55·0	52·5	65	...	...	2·19	9	3·7
Johannesburg	82·6	7	42·8	3	74·4	54·0	48·5	64	...	43·0	4·24	13	5·3
Mauritius	86·4	*29	63·2	25	82·6	67·8	63·2	69	...	58·2	1·35	11	5·5
Bloemfontein	88·5	6	40·7	16	80·5	52·3	49·6	53	...	...	2·56	9	4·1
Calcutta...	90·3	5	57·7	26	84·5	65·2	63·0	69	...	48·4	·04	1	4·0
Madras	87·6	23	70·9	11	83·7	75·0	75·8	88	161·6	60·5	39·18	23	7·6
Colombo, Ceylon ...	88·9	3	71·7	7	86·5	74·2	73·6	83	159·2	68·1	5·10	21	7·4
Hongkong	82·5	6	59·7	19	72·7	66·1	62·5	78	...	...	5·08	13	7·6
Sydney	94·3	14	49·7	29	73·2	59·6	54·4	66	139·0	45·0	1·27	10	5·8
Melbourne	94·0	23	39·8	18	68·9	50·1	46·5	60	144·2	31·0	·52	7	5·4
Adelaide	97·5	22	44·1	5	79·2	54·6	48·0	46	155·0	31·7	·26	4	3·7
Perth	94·6	24	48·0	13	77·0	59·2	55·8	65	156·4	37·1	·52	12	5·0
Coolgardie	102·5	21	49·8	13	88·9	59·0	46·4	32	167·0	47·2	·00	0	3·1
Brisbane	92·3	1	56·5	30	84·0	64·4	61·1	65	153·5	51·6	2·16	7	4·3
Hobart, Tasmania ..	84·4	9	39·2	29	64·0	48·4	43·4	59	146·0	32 9	1·23	14	6·0
Wellington ...	69·7	14	40·2	4	61·5	49·9	47·1	73	151·0	30·1	3·34	11	6·4
Jamaica, Kingston ..	90·3	15	66·1	9	87·3	70·7	69·2	79	...	...	·71	3	3·8
Grenada	86·0	5, 26	73·0	††9	84·0	75·0	...	80	135·0	...	6·54	25	4·5
Toronto	65·7	7	17·8	26	48·4	35·5	35·3	85	116·9	14·0	1·34	15	7·2
Fredericton	58·0	1	12·0	‡26	40·8	26·1	27·6	79	...	...	3·90	11	5·9
St. John, N.B. ...	54·7	1	13·5	27	42·1	31·1	30·3	76	108·7	10·7	5·34	11	5·7
Victoria, B.C.	54·5	5	34·0	‡26	49·3	41·5	41·0	86	110·0	24·0	3·28	18	7·4

*and 30. † 10. ‡ 27.

Johannesburg.—Bright sunshine 261·3 hours.

COLOMBO, CEYLON.—Mean temp. 80°·3, or 0°·8 above, dew point 0°·7 above, and R 5·84 in. below, averages. Mean hourly velocity of wind 2·6 miles. TS on 30th.

HONGKONG.—Mean temp. 69°·2. Bright sunshine 124·6 hours. Mean hourly velocity of wind 11·3 miles.

Melbourne.—Mean temp. 1°·8 below, and R 1·75 in. below, averages.

Adelaide.—Mean temp. normal and R ·91 in. below average.

Perth.—R ·25 in. below average.

Coolgardie.—Temp. 3°·2 above the average.

Brisbane.—Temp. 0°·2 above average.

Wellington.—Mean temp. 1°·2 below, and R ·22 in. below, averages. Bright sunshine, 191·8 hours. Heavy N.W. gale on 7th.

Symons's Meteorological Magazine.

No. 641. JUNE, 1919. Vol. LIV.

Richard Henry Curtis.

1847—1919.

The death of Mr. R. H. Curtis takes away one more of the rapidly diminishing band of veteran meteorologists whose professional careers date back to the earliest days of the Meteorological Office. In this magazine for April, 1912 (p. 53), we chronicled the retirement of Mr. Curtis from the Meteorological Office after a period of service extending to 51 years, and we refer our readers to that volume for the portrait which want of space prevents our reproducing. Mr. Curtis entered the Meteorological Department of the Board of Trade under Admiral Fitzroy in 1861. He was at first in the Telegraph Room, which afterwards became the Forecast Branch, and later in the Marine Department where he was a colleague of the late Mr. G. J. Symons until the latter left to take up his life-work at Camden Square. Mr. Curtis's great aptitude for devising and improving instruments led naturally to his appointment in 1907 as Superintendent of Instruments and Observatories, a position which he held until his retirement in 1912. During this period he made a special study of sunshine recording and introduced an improvement in the mounting of the Campbell-Stokes sunshine recorder which is now regarded as the standard form. He also carried out experiments on the distribution of wind-pressure on flat surfaces. The information thus gained was recently put to a severe practical test in the design of an automatic apparatus for warnings of dangerous wind velocities used on some Irish Light Railways. This apparatus was said to work better than any other designed for a similar purpose.

For the last 15 years or so of his life Mr. Curtis lived at Warlingham, where he carried on meteorological observations regularly until compelled to give them up a few weeks before his death.

He was for long a Fellow of the Royal Meteorological Society and was a valued member of the Council for many years.

THE ZODIACAL LIGHT.

By the late COMMANDER M. W. CAMPBELL HEPWORTH, R.N.R., C.B.

RECENT numbers of the Meteorological Office Circular include correspondence with reference to the Zodiacal Light. The present writer therein suggests that the cosmic matter from which the light is reflected may surround the earth, instead of being an appendage of the sun. The well known astronomer, the Rev. Marc Dechevrens, writes, expressing his opinion, in the Circular, that the Zodiacal Light pertains to the sun not to the earth.

Perhaps among the numerous readers of your Magazine, there may be some who, having been interested observers of the zodiacal light, would add their own opinions in this matter.

The principal reason for my belief that the cosmic matter from which the light is reflected pertains to the earth is that it is visible on every clear moonless night in the tropics, as a band of nebulous light stretching across the sky from the western to the eastern horizon, and *vice versa*, whereas Father Dechevrens bases his argument for the opposite view, mainly upon the supposition that the phenomenon can be seen only at certain periods during the year.

The accompanying notes relating to the Zodiacal Light are culled from three meteorological logs, which were contributed by myself to the Meteorological Office in the years 1898 and 1899, in which frequent entries are made of such occurrences.

The Rev. Marc Dechevrens is one of the leading astronomers of the day; his opinions, therefore, command every consideration. Displays of the Zodiacal Light, however, do not assume the same brilliancy in temporate latitudes as they do in tropical regions; I have the less hesitation, therefore, in differing from him in this connection.

Observations of the Zodiacal Light.

(Extracted from a Meteorological Log kept on board the R.M.S. *Aorangi*, by M. W. C. HEPWORTH, Lieut, R.N.R., Commander)

1899—August :—

8th	Noon	2° 47′ N.	168° 49′ W.
9th	Noon	2° 22′ S.	171° 33′ W.
10th	Noon	7° 38′ S.	174° 7′ W.

For several nights Zodiacal Lights have been visible from sunset to sunrise, reaching entirely across the sky, with a breadth of from from 18° to 23°, perfectly distinct and clearly outlined.

1898—November :—

30th	8—8.30 p.m. ..	2° 13′ S.	171° 54′ W.

December :—

1st	8—9 p.m. ..	7° 23′ S.	174° 28′ W.

Zodiacal Lights very distinct showing plainly from western horizon to a little beyond the zenith and faintly onwards to the eastern horizon, thus being visible from Sagittarius through the successive Zodiacal constellations to Gemini, Pisces being in the zenith.

2nd ..... 8—9 p.m. .. 11°42′ S. 176° 27′ W.
Zodiacal Lights very distinct (as on the two previous nights) until moonrise at 10.15 p.m. extending from Scorpio to Gemini.

7th ..... 8.15—10.15 p.m. 30° 1′ S. 178° 53′ E.
Zodiacal Lights visible from Scorpio in Lr. S.W. to Taurus in N.E.

13th ..... 8.30 p.m. to mdnt. 34° 30′ S. 153° 30′ E.
Zodiacal Lights appear over and across western horizon, shining moderately brightly from Aquarius to Taurus and gradually setting.

Occasions on which the Zodiacal Light was visible but did not extend between E. and W. horizon across the celestial Concave.

1899—January :—

9th	8—10 p.m. ..	20° 33′ S.	178° 3′ E.
10th	8—9 p.m. ..	17° 1′ S.	178° 14′ E.
10th	7—9.30 p.m. ..	12° 43′ S.	176° 59′ W.
11th	8 p.m. ..	8° 18′ S.	174° 24′ W.
12th	7.30—11 p.m...	3° 0′ S.	172° 4′ W.
13th	7.30—10 p.m ..	1° 39′ N.	169° 50′ W.
14th	8.30—11 p.m.	6° 6′ N.	167° 13′ W.
15th	10—11 p.m. ..	11° 12′ N.	163° 52′ W.
16th	11—midnight..	15° 14′ N.	161° 9′ W.

1898—June :—

14th	6—8 p.m. ..	2° 7′ N.	169° 41′ W.

Remarkably bright in south.

16th	7—8 p.m. ..	8° 23′ S.	175° 7′ W.

1897—December :—

21st	From	
	23° 49′ N.	155° 34′ W.
22nd	to	
23rd	13° 31′ N.	162° 52′ W.
24th		

During the evenings of the 21st, 22nd, 23rd and 24th, the Zodiacal Lights were most distinctly visible from the horizon, in Sagittarius, through Capricornus, Aquarius, Pisces, gradually growing fainter and more indistinct, but still to be traced into Aries and even Taurus on the opposite side of the Zenith. Again each of these mornings just before sunrise they were very distinct from Sagittarius, through Scorpio, Libra, Virgo, until lost in Leo, almost at the zenith. Thus in the course of 24 hours they could be seen through ten out of the twelve "Signs of the Zodiac."

On the 22nd, at 8 p.m., Zodiacal Lights were very clearly visible to an altitude of 80°.

May :—

19th ..... 6—8.45 p.m. .. 5° 35′ S. 173° 30′ W.
Zodiacal Lights faintly visible in east to an altitude of 60°.

20th ..... 7.45—8.45 p.m. 2° 37′ S. 171° 30′ W.
Zodiacal Lights faintly visible.

June :—

28th ..... 7 p.m. .. 11° 42′ 162° 26′ W.
Zodiacal Lights brilliant from W.S.W. to N. by W. at altitude 40°.

Correspondence.

To the Editor of Symons's Meteorological Magazine

THE SPRING EQUINOX.

In the Weather Report in *The Times* of March 22nd is the following passage :—"The incursion of the present type of weather with north-east winds, dull weather, and occasional sleet or snow, about the vernal equinox, usually portends the persistence of similar conditions over several days."

I have so often noticed the occurrence of snow at the period of the vernal equinox that I once drew the attention of a more experienced meteorologist than myself to the matter, but he said it was a mere coincidence. I think it is more than a coincidence, and that there must be some cause connected with the equinox itself to bring it about or why should it be such a frequent happening? In some years, after winters which have been almost snowless, the inevitable fall has occurred about March 21st.

I have looked up old weather registers for the last 100 years, (Luke Howard, 1820-9, a well kept register in Suffolk, 1830 to 1882, and my own, from 1883 to 1919), and find that in the 100 years snow is reported as having fallen between March 18th and 25th in no less than 52 years. What is the explanation?

Christchurch Lodge, Eaton, Norwich. ARTHUR W. PRESTON.

DEW PONDS.

I was very glad to see the letter from Dr. J. R. Sutton in your last number because in the interest of scientific accuracy it is most desirable that the statements made by Mr. Hubbard in his communication to the Institute of British Architects regarding the maintenance of ponds by dew or mist should be corrected. It is strange how this belief persists and what evidence is considered good enough to bring forward in its support. Mr. Hubbard's paper is full of statements for which there is really no satisfactory evidence whatever. For example, he accepts without question the story of the shepherd who measured a rise of eight inches in five rainless nights on a "dew pond"! Few people, however, take the trouble to weigh evidence and the miraculous has great attractions for many of us. But there is really no mystery about the maintenance of the so-called dew ponds. They are merely rain water receptacles and they are maintained because the rainfall affecting them is greater than the evaporation. This would be so even if they had no area draining to them, but this is never the case. I will take as an

example, the well known pond on the Downs, near Patcham, in Sussex. This pond has a water surface of 6,361 square feet, and a margin draining to it 15 feet in width. The area upon which the amount of rainfall must be calculated is therefore 10,568 sq. feet. The evaporation, taken on the area of the water surface, is based upon the records of the late Mr. Baldwin Latham, at Croydon.

The following table gives the profit and loss account in an average year, taking the rainfall at 30 inches which is somewhat under the mark :—

Month.	Rainfall.	Evaporation from Water Surface.	Rainfall.	Evaporation from Water Surface.	Difference.
	Inches.		Gallons.		
Jan. ...	2·13	0·25	11,728	828	10,900
Feb. ...	2·13	0·34	11,728	1,126	10,602
Mar. ...	2·07	0·94	11,397	3,113	8,284
April...	2·01	1·80	11,067	5,962	5,105
May ...	2·07	2·70	11,397	8,942	2,455
June ...	2·64	3·12	14,536	10,333	4,203
July ...	2·73	3·30	15,031	10,930	4,101
Aug. ...	2·64	2·70	14,536	8,942	5,594
Sept....	2·34	1·50	12,884	4,968	7,916
Oct. ...	3·51	0·82	19,326	2,716	16,610
Nov. ...	3·09	0·43	17,014	1,424	15,590
Dec. ...	2·64	0·23	14,536	762	13,774
Totals	30·00	18·13	165,180	60,046	105,134

These figures show a balance over the whole year of upwards of 105,000 gallons, or for the six months, April to September, of more than 28,000 gallons, equal to 150 gallons a day due to the increment alone. If to this be added the contents of the pond at an average depth of two feet, we have 108,000 gallons available during the six months for watering sheep or cattle, or nearly 600 gallons a day. In a year of average rainfall, therefore, it is not to be wondered at that the pond should easily last the summer through. It is well known, however, that these ponds fall very low in exceptionally dry years. Such a year was 1911. In that year the profit and loss account, worked out in the same way as for an average year, shows that so far from there being a balance of rainfall over evaporation on the Patcham Pond in the six months, April to September, there was a loss of nearly 8,000 gallons. Notwithstanding this, if the pond were perfectly watertight, and unless the draught upon it were very heavy, it would not fail. It follows that there is no reason to look for any cause other than rainfall for the replenishment of ponds of the character dealt with by Mr. Hubbard in his paper.

7, Queen Anne's Gate, May 30th, 1919. W. VAUX GRAHAM.

SUMMER AND WINTER TEMPERATURE VARIATIONS.

ALMOST as important as the difference in the general level of temperature between the summer and winter solstitial periods is the different type of temperature variation at the two seasons. It is well known, of course, though hardly sufficiently realized as a climatic contrast, that the diurnal range of temperature is large in summer but small in winter, and this, I suppose, is a good natural illustration of the law of cooling. In summer while the variation of temperature between day and night is very marked, the day to day vicissitudes, except when a sudden change in the type of weather occurs are not prominent. In winter, on the other hand, while the diurnal range is small the irregular non-periodic fluctuations of temperature associated with cyclonic wind changes are very conspicuous, with the result that the highest temperature of the "day" not infrequently occurs during the night. The latter occurrence is often quoted as something paradoxical, whereas viewed in the proper climatic light it should be regarded as quite a characteristic seasonal contingency between November and February. I do not know how often the highest temperature for the twenty-four hours has occurred during the night between May and August, but the instances must be very few relatively, and limited presumably to the occasions of a sudden change to a colder type of weather taking place in the early morning hours.

L. C. W. BONACINA.

27, Tanza Road, Hampstead, N.W. 3, June 3rd, 1919.

THUNDERBOLT AT DETLING.

THE following account is from the *Kent Messenger* of April 12th, 1919.

> What is generally termed a "thunderbolt" caused some alarm during the thunderstorm on Wednesday afternoon, when about three o'clock, it fell on Detling Hill. The occupants of a motor lorry belonging to Messrs. Style and Winch were coming down the hill, when, following an unusually vivid flash of lightning and a heavy crash of thunder, they saw what appeared to be a flaming hot cannon ball shoot across the road just in front of them, smash through some "spiles," or fencing, and cut a tree before taking to earth with a violent explosion. This must not be confused with the ordinary meteorite, but is regarded as an interesting instance of what is known scientifically as "ball-lightning," an as yet unexplained phenomenon.

Men are trying to dig it out for preservation in the Maidstone Museum. The hole in the ground is about 2 inches in diameter. This I had from the men who are digging.

RICHARD COOKE.

The Croft, Detling, Maidstone, April 14th 1919.

MAMMATO-CUMULUS CLOUD.

REFERRING to the letter on Mammato-Cumulus in your last number, I may say these clouds are not infrequent in southern France; but they are of little value for forecasting weather, because they appear in the rear of thunderstorms or local squalls. To my mind, the Mammato-Cumulus seen in southern France indicates a reversal of the normal air currents, going downwards, in fact, and the festooned appearance suggests the crest of a wave breaking towards the earth.

I never saw the *pocky* or *mackerel* sky described in English meteorologies. M. MOYE.

12, rue du Faubourg-Boutonnet, Montpellier, France. May 21st, 1919.

ROYAL METEOROLOGICAL SOCIETY.

A MEETING of this Society was held on May 21st, at 70, Victoria Street, S.W., Sir Napier Shaw, F.R.S., President, in the Chair.

A paper by Capt. C. J. P. Cave, and Mr. J. S. Dines, entitled, "Further Measurements on the Rate of Ascent of Pilot Balloons," was read by Mr. Dines. The paper discussed experiments made in the Albert Hall, in which a clear height of 40 metres is available from floor level to the grid at the centre of the domed roof. The formula in general use for the rate of ascent is, Rising Velocity, $V = q. \sqrt{L} \div \sqrt[3]{W + L}$, where L = the free lift and W the dead weight of the balloon and q is a constant the value of which has to be determined under different conditions. It had been suggested that the value of q varied with different degrees of loading of the balloon. Attention was directed to this question and quantitive results obtained. Measurements were also made with a candle lantern of the pattern used for night ascents hung below the balloon. It was found that this produced no effect upon q. In timing the rate of ascent in closed buildings a fine thread has generally been attached to the neck and has been drawn up from the floor as the ascent proceeded. In the present case experiments which were made with and without such a thread showed that some correction is necessary where a thread is used. The general results confirmed the value $q = 84$, which is used at the present time, for balloons of the size generally adopted for pilot balloon work. This value gives velocities in metres per minute when lift and deadweight are expressed in grammes.

In the discussion which followed Lieut.-Col. Gold said that a considerable difference might exist between the rates of ascent in the open air and in a closed room. It would be of advantage if experiments could be conducted alongside the Eiffel Tower (400 metres high) with Observers stationed on each platform. He carried out experiments with two theodolites in France, and the resulting rates of ascent varied from 100 to 300 metres per minute. Sir

Napier Shaw thought the fact that several ascents were considered necessary for any conclusive result was very disturbing. It was desirable to devise a means of insuring the balloon rising in a straight line. Messrs. Bryant, Hopkinson and Silvester also spoke.

"The Report on the Observations for the Phenological Year, December, 1917, to November, 1918," by Mr. J. Edmund Clark and Mr. H. B. Adames was also presented. The excessive cold of December, 1917, was followed by three mild months. By April 1st blackthorn was in most parts blooming, and rarely had the farm and garden promise at this date been so satisfactory. The mid-April bitter weather was disastrous to the opening fruit tree buds, and a continuation of summer drought and coolness continued the prejudicial conditions. A genial August greatly favoured the earlier harvest districts, but the excessive wet in September caused damage and loss elsewhere. The whole autumn was cool, but comparative dryness in October and November helped finally in the harvesting of nearly average field crops. Potatoes gave a record for acreage and yield per acre. The migrant records supported the interesting weather relationships shown by the other tables. The isophenal lines on the map indicated the districts where plants blossomed simultaneously. Their course showed the marked influence of elevation. On the same map were also shown the isotherms for the first half of the year. The effect of the war was felt in the loss of many Observers who formerly contributed to this report and an increase in the present numbers is to be desired, particularly in the northern districts and in Ireland.

Lieut.-Col. Gold suggested that the results of the long series of observations should be summarised in the form of a general survey of the subject of phenology. The isotherms and the isophenes should be given on different charts with the addition of sunshine values.

The following were elected Fellows of the Society :—Lieut. H. W. L. Absalom, R.E., E. V. Bacon, M.B.E., M.A., S. S. Burlingham, G. O. Capell, R.A.F., Admiral R. B. Farquhar, C.B., Miss E. H. Geake, M.Sc., A. J. Grant, G. B. Hamlin, Comm. G. Robinson Hudson, R.N.R., C. W. Lamb, Capt. P. A. Smee, R.A.F.

METEOROLOGICAL NEWS AND NOTES.

Meteorological Libraries.—The Council of the Royal Meteorological Society desire to call attention to the desirability of establishing meteorological libraries in important centres throughout the country. For this purpose they would suggest to those who possess series of meteorological publications, for which they have no permanent use, that they should offer them to form a nucleus for a library in some suitable place. The Society is prepared to supplement such libraries on the understanding that they will be ultimately available for public use.

THAMES VALLEY RAINFALL. MAY. 1919.

THE WEATHER OF MAY.

OVER by far the greater part of Great Britain a marked predominance of anticyclonic weather resulted last month in one of the warmest and driest Mays on record. In Ireland, where the conditions were influenced very frequently by cyclonic systems moving over the Atlantic, the weather was of a more normal character.

During the opening week the effect of the oceanic disturbances was felt more or less over the United Kingdom generally, the winds being mainly from S. or S.W., and the weather changeable and rather cool. On the night of the 3rd a sharp ground frost occurred over North Britain, the exposed thermometer falling to a minimum of 19° at Balmoral and 21° at Crathes (Kincardineshire).

After the 6th barometic pressure became high in the north, and easterly winds therefore set in, slight ground frosts being experienced on the night either of the 7th or 8th in many localities, as far south as Greenwich. Between the 9th and 11th, when a shallow depression spread over the country from the south-westward, the conditions were again rather changeable. Thunderstorms occurred in the London district and some other portions of the south-eastern counties on the 9th, and at a number of western and northern stations on the 11th. After the latter date the type of weather in all but the western and south-western districts was almost continuously anticyclonic, the highest pressures being situated at first over northern Europe, afterwards over the North Sea, and finally over the United Kingdom. An extension of fine sunny weather proceeded in a similar fashion, and with winds blowing mainly from some easterly quarter the air became exceedingly dry. During the last fortnight there were many days upon which the relative humidity fell below 50 per cent.; at Kew and Leith there were five days on which it fell below 40 per cent., and at Eskdalemuir there were 6 days on which it fell below 30 per cent. In nearly all districts temperature rose to a very high level for the time of year. On the 23rd shade maxima of 80° or slightly more were recorded over eastern and central England, and towards the close of the month readings only a trifle below that level were observed in nearly all parts of the United Kingdom. At many English stations the mean of all the daily maxima for the month was more than 6° above the average, the value at Kew being the highest recorded in May, as far back at all events as 1871.

The effect of a warm air blowing over the cool sea surface was seen in a considerable prevalence of coastal fog, and at a few places in the west and south-west the total duration of bright sunshine was below the average. Over the country generally there was, however, a large excess.

The month was remarkably dry over the whole of Great Britain, the deficiency exceeding 75 per cent. of the average in the south and east of England, in Glasgow and the north of Scotland. The total fall was less than ·50 inch over a great part of the Thames Valley and East Anglia, and exceeded 2 inches only in the mountain districts of Wales, Cumberland, and the Scottish Highlands. An absolute drought was experienced during the latter part of the month at many widely distributed stations. It was most marked in the Thames Valley where no rain fell after the 11th except at a few stations where the drought was broken by slight precipitation on the 25th. Ireland was generally rather wet and nearly twice the average fell at Glanmire (Co. Cork). The amounts varied from rather less than 2 inches in the north and east to more than 8 inches at exposed stations in Co. Mayo. The general rainfall expressed as a percentage of the average was :—England and Wales, 41; Scotland, 41; Ireland, 120; British Isles, 62.

In London (Camden Square) it was both the third driest and the third warmest May in 62 years' record. Mean temperature 58°·5 or 4°·5 above the average. Duration of sunshine 217·9 hours, and of rainfall 5·6 hours. Evaporation 2·94 inches.

RAINFALL TABLE FOR MAY, 1919.

STATION.	COUNTY.	RAINFALL.						
		Aver. 1875—1909. in.	1919. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days
Camden Square	*London*	1·75	·33	—1·42	19	·18	2	4
Tenterden	*Kent*	1·65	·46	—1·19	28	·22	25	6
Arundel (Patching)	*Sussex*	1·80	·30	—1·50	17	·10	11	6
Fordingbridge (Oaklands)	*Hampshire*	2·09	·68	—1·41	33	·27	6	9
Oxford (Magdalen College)	*Oxfordshire*	1·81	·40	—1·41	22	·30	6	4
Wellingborough (Swanspool)	*Northampn*	1·98	1·22	— ·76	62	·96	6	6
Bury St. Edmunds (Westley)	*Suffolk*	1·93	·37	—1·56	19	·14	1	5
Geldeston [Beccles]	*Norfolk*	1·78	·69	—1·09	39	·30	7	7
Polapit Tamar [Launceston]	*Devon*	2·08	1·67	— ·41	80	·63	14	13
Rousdon [Lyme Regis]	,,	2·02	·98	—1·04	49	·28	14	8
Ross (Birchlea)	*Herefordshr.*	2·10	·33	—1·77	16	·11	5	8
Church Stretton (Wolstaston)	*Shropshire*	2·64	1·30	—1·34	49	·84	15	6
Boston	*Lincoln*	1·80	·67	—1·13	37	·22	24	6
Worksop (Hodsock Priory)	*Nottingham*	2·08	1·07	—1·01	51	·45	6	8
Mickleover Manor	*Derbyshire*	2·10	1·21	— ·89	58	·31	6	8
Congleton (Buglawton Vic.)	*Cheshire*	2·33	1·09	—1·24	47	·43	6	10
Southport (Hesketh Park)	*Lancashire*	2·13	1·10	—1·03	52	·52	24	8
Wetherby (Ribston Hall)	*York, W.R.*	2·09	1·09	—1·00	52	·27	1	10
Hull (Pearson Park)	,, *E.R.*	1·98	·84	—1·14	42	·30	1	7
Newcastle (Town Moor)	*North'land*	2·04	·92	—1·12	45	·20	8	11
Borrowdale (Seathwaite)	*Cumberland*	7·50	2·17	—5·33	29	...	...	...
Cardiff (Ely)	*Glamorgan*	2·56	·89	—1·67	35	·19	3	11
Haverfordwest	*Pembroke*	2·62	1·47	—1·15	56	·45	11	13
Aberystwyth (Gogerddan)	*Cardigan*	2·63	1·30	—1·33	49	·54	24	11
Llandudno	*Carnarvon*	1·86	1·09	— ·77	59	·38	15	9
Cargen [Dumfries]	*Kirkcudbrt.*	2·87	1·00	—1·87	35	·26	10	11
Marchmont House	*Berwick*	2·53	1·53	—1·00	60	·59	11	8
Girvan (Pinmore)	*Ayr*	2·98	1·10	—1·88	37	·31	2	13
Glasgow (Queen's Park)	*Renfrew*	2·40	·51	—1·89	21	·10	3, 4	7
Islay (Eallabus)	*Argyll*	2·58	1·53	—1·05	59	·38	20	9
Mull (Quinish)	,,	2·99	2·22	— ·77	74	·47	23	16
Loch Dhu	*Perth*	4·59	2·00	—2·59	44	·45	4	13
Dundee (Eastern Necropolis)	*Forfar*	2·05	1·01	—1·04	49	·43	6	12
Braemar	*Aberdeen*	2·33	1·65	— ·68	71	·60	30	8
Aberdeen (Cranford)	,,	2·40	·53	—1·87	22	·24	25	5
Gordon Castle	*Moray*	2·10	·28	—1·82	13	...	...	...
Drumnadrochit	*Inverness*	2·33	·54	—1·79	23	·16	11	7
Fort William	,,	3·93	1·39	—2·54	35	·36	11	13
Loch Torridon (Bendamph)	*Ross*	4·54	1·52	—3·02	34	·35	2	10
Dunrobin Castle	*Sutherland*	2·19	·50	—1·69	23	·45	11	2
Glanmire (Lota Lodge)	*Cork*	2·54	5·00	+2·46	197	2·02	13	9
Killarney (District Asylum)	*Kerry*	3·05	3·54	+ ·49	116	·70	14	20
Waterford (Brook Lodge)	*Waterford*	2·33	3·82	+1·49	164	1·18	14	14
Nenagh (Castle Lough)	*Tipperary*	2·51	3·92	+1·41	156	1·49	13	18
Ennistymon House	*Clare*	2·70	3·32	+ ·62	123	·88	14	17
Gorey (Courtown House)	*Wexford*	2·24	1·82	— ·42	81	·82	20	14
Abbey Leix (Blandsfort)	*Queen's Co.*	2·43	2·88	+ ·45	118	·75	14	14
Dublin (Fitz William Square)	*Dublin*	2·07	1·65	— ·42	80	·48	14	13
Mullingar (Belvedere)	*Westmeath*	2·51	2·23	— ·28	89	·45	20	11
Crossmolina (Enniscoe)	*Mayo*	3·17	3·50	+ ·33	111	·55	1	22
Cong (The Glebe)	,,	2·94	..	...	...	...	...	...
Collooney (Markree Obsy.)	*Sligo*	2·80	4·01	+1·21	143	·83	14	18
Seaforde	*Down*	2·72	4·27	+1·55	157	1·42	11	13
Ballymena (Harryville)	*Antrim*	2·84	2·20	— ·64	77	·42	13	13
Omagh (Edenfel)	*Tyrone*	2·66	1·84	— ·82	69	·29	1	18

SUPPLEMENTARY RAINFALL, MAY, 1919.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches
II.	Sevenoaks, Speldhurst Close.	·08	XI.	Lligwy	1·04
,,	Ramsgate	·23	,,	Douglas, Isle of Man	2·28
,,	Hailsham	·22	XII.	Stoneykirk, Ardwell House...	1·46
,,	Totland Bay, Aston House...	·46	,,	Carsphairn, Shiel	1·44
,,	Stockbridge, Ashley	·47	,,	Langholm, Drove Road	1·65
,,	Grayshott	·41	XIII.	Selkirk, The Hangingshaw..	1·59
,,	Upton Nervet	·27	,,	North Berwick Reservoir	·65
III.	Harrow Weald, Hill House...	·52	,,	Edinburgh, Royal Observaty.	·66
,,	Pitsford, Sedgebrook	·93	XIV.	Biggar	·79
,,	Woburn, Milton Bryant	·70	,,	Maybole, Knockdon Farm ...	·34
,,	Chatteris, The Priory	·58	XV.	Shiskine	1·47
IV.	Elsenham, Gaunts End	·32	,,	Ardgour House	2·02
,,	Rayleigh	·36	,,	Oban	1·39
,,	Colchester, Hill Ho., Lexden	·65	,,	Holy Loch, Ardnadam	1·86
,,	Aylsham, Rippon Hall	·81	,,	Loch Venachar	1·60
,,	Swaffham	·44	XVI.	Glenquey	1·50
V.	Bishops Cannings	·82	,,	Loch Rannoch, Dall	1·40
,,	Weymouth	·81	,,	Blair Atholl	...
,,	Ashburton, Druid House	1·60	,,	Coupar Angus	1·25
,,	Cullompton	·81	,,	Montrose, Sunnyside Asylum.	·70
,,	Lynmouth, Rock House	·84	XVII.	Balmoral	1·34
,,	Okehampton, Oaklands	...	,,	Fyvie Castle	·47
,,	Hartland Abbey	1·29	,,	Keith Station	·39
,,	St. Austell, Trevarna	2·05	XVIII.	Rothiemurchus	...
,,	North Cadbury Rectory	·68	,,	Loch Quoich, Loan	3·60
VI.	Clifton, Stoke Bishop	·34	,,	Skye, Dunvegan	2·68
,,	Ledbury, Underdown	·62	,,	Fortrose	·35
,,	Shifnal, Hatton Grange	·73	,,	Glencarron Lodge	1·38
,,	Droitwich	·67	XIX.	Tongue Manse	·87
,,	Blockley, Upton Wold	·81	,,	Melvich	·31
VII.	Grantham, Saltersford	1·99	,,	Loch More, Achfary	1·37
,,	Louth, Westgate	·57	XX.	Dunmanway, The Rectory	4·60
,,	Bawtry, Hesley Hall	·82	,,	Mitchelstown Castle	4·68
,,	Derby, Midland Railway	1·36	,,	Gearahameen	6·50
VIII.	Nantwich, Dorfold Hall	·69	,,	Darrynane Abbey	3·64
,,	Bolton, Queen's Park	1·83	,,	Clonmel, Bruce Villa	4·06
,,	Lancaster, Strathspey	1·63	,,	Roscrea, Timoney Park	3·51
IX.	Langsett Moor, Up. Midhope	1·67	,,	Broadford, Hurdlestown	3·12
,,	West Witton	1·59	XXI.	Enniscorthy, Ballyhyland...	2·81
,,	Scarborough, Scalby	1·33	,,	Rathnew, Clonmannon	1·88
,,	Ingleby Greenhow	·90	,,	Hacketstown Rectory	2·54
,,	Mickleton	·75	,,	Ballycumber, Moorock Lodge	2·83
X.	Bellingham, High Green Manor	1·61	,,	Balbriggan, Ardgillan	1·51
,,	Ilderton, Lilburn Cottage	·52	,,	Castle Forbes Gardens	3·47
,,	Keswick, The Bank	2·99	XXII.	Ballynahinch Castle	3·84
,,	Orton	1·88	,,	Woodlawn	3·54
XI.	Llanfrechfa Grange	·34	,,	Westport House	3·29
,,	Treherbert, Tyn-y-waun	2·34	,,	Dugort, Slievemore Hotel	5·86
,,	Carmarthen, The Friary	1·49	XXIII.	Enniskillen, Portora	3·26
,,	Fishguard, Goodwick Station.	1·36	,,	Dartrey [Cootehill]	3·16
,,	Crickhowell, Tal-y-maes	1·10	,,	Warrenpoint, Manor House	2·17
,,	Birmingham WW., Tyrmynydd	·72	,,	Belfast, Cave Hill Road	1·52
,,	Lake Vyrnwy	1·38	,,	Glenarm Castle	..
,,	Llangynhafal, Plas Drâw	1·36	,,	Londonderry, Creggan Res...	1·36
,,	Rhiwbryfdir	3·06	,,	Milford Manse	1·67
,,	Dolgelly, Bryntirion	1·56	,,	Killybegs	3·34

Climatological Table for the British Empire, December, 1918.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	58·6	3	26·9	26	50·5	41·0	43·8	92	79·7	20·3	2·34	24	7·8
Malta	66·6	10	48·0	2	61·1	53·1	...	85	117·0	43·0	3·69	14	2·3
Lagos	90·3	9	70·0	21	88·0	74·3	21·1	71	154·3	60·3	·02	1	7·8
Cape Town	89·7	31	53·7	27	76·8	59·1	54·7	64	...	...	·86	7	3·8
Johannesburg	85·2	16	47·4	1	75·6	55·5	53·8	74	...	48·8	7·58	13	6·5
Mauritius	91·2	20	64·0	17	87·0	70·0	66·0	67	...	56·5	·82	8	4·4
Bloemfontein	97·1	18	47·3	20	85·6	57·3	52·2	49	..	...	1·35	7	4·8
Calcutta...	81·2	13	49·7	21	77·0	55·2	52·2	64	...	39·9	·49	2	1·8
Madras	86·0	16	67·2	30	83·1	72·0	69·5	80	156·7	62·5	6·67	8	5·3
Colombo, Ceylon ...	89·1	20	68·2	29	86·1	72·6	71·2	80	160·8	63·6	4·45	17	7·0
Hongkong	78·6	20	49·2	28	68·9	62·4	59·7	80	...	...	·14	4	8·2
Sydney	101·0	20	53·8	1	79·8	62·0	56·0	59	161·0	39·8	·89	7	4·0
Melbourne	...	...	...	...	...	...	...	...	...	...	...	...	...
Adelaide	107·8	9	46·4	21	84·2	58·5	49·6	42	165·0	37·2	·62	5	3·2
Perth	100·7	31	54·4	3	81·2	59·9	57·0	64	159·8	47·3	·24	5	2·5
Coolgardie	107·2	5, 7	49·5	13	93·0	60·6	46·4	28	175·2	48·0	·11	2	1·6
Brisbane	101·1	3	57·9	1	85·1	67·8	63·3	66	157·2	53·4	·88	7	4·7
Hobart, Tasmania ..	91·3	23	43·0	21	69·1	51·7	44·8	53	157·0	37·2	1·81	14	6·9
Wellington ..	74·6	17	42·9	14	63·9	51·4	48·2	72	149·0	30·0	2·73	11	5·3
Jamaica, Kingston ..	91·4	10	66·6	27	87·5	70·3	68·0	79	...	...	·57	10	4·1
Grenada	86·0	31	71·0	Sev.	83·0	74·0	...	77	137·0	...	4·39	16	4·5
Toronto	50·8	14	13·7	1	37·2	25·4	26 7	86	104·4	4·8	3·30	13	7·3
Fredericton	49·0	23	− 5·5	8	28·0	12·9	15·2	83	...	...	2·26	12	6·0
St. John, N.B. ...	47·4	15	3·0	31	31·2	19·1	22·0	79	99·2	1·5	3·11	14	6·3
Victoria, B.C.	51·2	14	30·2	31	44·6	37·1	38·0	88	98·0	23·5	7·15	17	7·0

and 26.

Johannesburg.—Bright sunshine 242·1 hours.

Bloemfontein.—Total R for the year 24·18 in., falling on 73 days.

COLOMBO, CEYLON.—Mean temp. 79°·4, or 0°·5 above, dew point 0°·2 above, and R ·15 in. above, averages. Mean hourly velocity of wind 4·4 miles. TSS on 5 days. Prevailing direction of wind was north.

HONGKONG.—Mean temp. 65°·2. Bright sunshine 108·9 hours. Mean hourly velocity of wind 13·6 miles.

Adelaide.—Mean temp. 0 ·2 above, and R ·34 in. below, averages.

Perth.—R ·34 in. below average.

Coolgardie.—Temp. 1°·0 above, and R about ·50 in. below, averages.

Brisbane.—Temp. 0 ·2 below, and R 4·07 in. below, averages.

Wellington.—Mean temp. 2°·7 below, and R ·56 in. below, averages. Bright sunshine, 219·9 hours. Frost on 2 mornings. TS on night of 30th.

Symons's

Meteorological Magazine.

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ITALIAN CLOUD ATLAS.*

By L. C. W. Bonacina.

The beauty of the clouds in regard to form, colour and grouping is of a high order, and has been extensively portrayed in writing, painting and photography. Until the last few years, however, our scientific knowledge of them was rather meagre, and this for the very good reason that we had practically no means of reaching the shifting masses of condensed or frozen vapour that form in the free air. The rapid development of aviation which the war stimulated has, however, resulted in the acquisition of valuable knowledge regarding the various kinds of cloud and the process of condensation; and in this connection I would particularly draw attention to the valuable flying observations of Lieut. C. K. M. Douglas, who has shown, for example, that the dazzling white summits of cumulo-nimbus or thunder clouds are not frozen but consist of super-cooled droplets until the false cirrus stage arrives when the whole mass turns bodily into snow. But apart from such purely scientific ends it is clear that the aeronaut has much practical concern with all that appertains to cloud formation. An airman might not, indeed, contemplate a massive thunder pile with the same dread with which the navigator would an iceberg; but he, nevertheless, finds it advisable to avoid formations of that character for not only are such clouds highly charged with electricity, but constituting the visible heads of powerful ascending currents they indicate the seat of violent turbulence with sudden changes of wind velocity. Modern engineering, in fact, has imparted an enhanced realism to the region of the clouds with the inevitable result that every new work on clouds, as on meteorology is general, is sure to attract more

*R. Ufficio, Centrale di Meteorologia e Geodinamica, Roma. Luigi Taffara. Le Nubi. Parte I.: Testo. Parte II.: Atlante. Rome, 1917. Size 10 × 14, pp. 67, pl. xxvi. *Illustrations in text.*

notice than was formerly the case. Hence it becomes an added pleasure to draw the attention of readers to the handsome cloud atlas which has been complied by the Italian Meteorological Office. The reproductions from photographs in this collection are good, on the whole decidedly more impressive than those in the International Cloud Atlas (1910) or the Belgian Atlas (1907), upon which the Italian atlas, in regard to the system of cloud nomenclature used, is modelled. There is a good example of those exquisitely delicate fleecy flakes of upper cloud which we in England are accustomed to call Cirro-Cumulus rather than Alto-Cumulus, but is here designated Alto-Cumulus Granosus in accordance with the peculiar system of nomenclature adopted—an illustration, surely, of the folly of detailed cloud classification. Very striking, indeed, are two photographs of the lower cumuloform thunder clouds taken in Rome on July 31st, 1913, and named Cumulus Compositus. One may study the clouds as physical phenomena, on the one hand, which relegates them to the domain of pure meteorology; or as expressions of climate, on the other hand, which immediately connects them with geography In the present atlas the climatic aspect of the subject is happily not overlooked inasmuch as the place and date of occurence are given for each of the cloud specimens illustrated in the twenty-six plates, which refer mainly to Rome, Paris and Catania, in Sicily, but represent a few other places as well. The International Atlas, on the other hand, has the serious defect of affording no indication whatever of times and places, which means that as a *climatological* study and as a contribution to geography, whose distinctive function is to treat of what concerns *regions*, it is quite a failure. So inadequate, however, is the geographical representation in the Italian work that it would have been, climatically speaking, more consistent if the author had confined his collection solely to clouds seen in Italy, just as the Belgian atlas comprises only Belgian clouds, and as a cheap little atlas recently published by our own Meteorological Office exhibits only clouds observed at Aberdeen. In this connection I would observe that it would be a valuable contribution to climatology and meteorology alike were each country to bring out from time to time a pictorial selection of its own cloud occurrences. Although the several cloud types in their broad outlines are common to the whole world it is equally true that in their minor features the clouds are closely dependent upon geographical conditions, and it is accordingly a great pity that this most interesting question has received so little systematic study. There is a passage in Ruskin's "Modern Painters" (Vol. V., ch. 3) to the effect that "the true high cirri never cross a mountain in Europe" and that "the true cumulus is never seen in a great mountain region, at least in association with hills" being "always broken up and modified by them." If Ruskin's observation is substantially correct, and his generalization would certainly seem to have the support of

theory, in maintaining that the high mountains are unfavourable to the genesis of those compact storm ranges of infinite grandeur so often seen in the plains, I would particularly emphasize this : that it is a wise dispensation which accords to dwellers in the more monotonous plains occasional glimpses of accumulations of clouds which is their type-form are strongly suggestive of mountain systems.

I have often noticed when at the sea-side how decidedly the marine cumulus which tends to develop at night or in the early morning differs in complexion and texture from the more clear-cut hard-edged land cumulus which forms by day or late in the afternoon. Along the English coasts both kinds may in certain phases of summer weather be seen to perfection, the morning form out at sea and the evening variety inland. I think I may safely attribute this difference between the sea-born and the land-born varieties of cumulus to differences in the character of that convectional driving power which is the source of every true cumulus : for it must be remembered that while day convection over the land is associated with the effects of surface heating the somewhat less vigorous action at a lower general level of temperature which takes place by night over the sea is connected with the fact that out at sea the diurnal range of temperature in the higher atmospheric levels at about 4,000 feet is much greater than that in the air close to the surface of the water.

The text in the Italian work will be of great utility to those who may take up practical cloud observations though it may possibly strike some as too technical to be a suitable accompaniment to a series of pictures for whose publication the apology is evidently the artistic skill displayed ; it discusses cloud photography and nomenclature and describes various kinds of nephoscope for observing with precision the motion of clouds. Mention may be made of an apparatus devised by the compilor of the atlas which combines the function of photographic camera, theodolite, and nephoscope so that the height and motion of the cloud photographed can be obtained. The system of nomenclature which is that used in the Belgian atlas, though apparently appreciated in France, is little known in England, and in any case is much too detailed to be of real utility. It is thoroughly inexpedient to attempt to classify clouds closely or to go beyond the primary division into such fundamental forms as *Cirrus*, *Stratus*, and *Cumulus*, or such definite intermediate forms as Cirro-Cumulus, Cirro-Stratus, Alto-Cumulus, and Alto-Stratus. The International Meteorological Committee fixed upon ten typical names and it is not wise to adopt any more for fear of confusion. The clouds, indeed, are much better described than classified.

It might be added that there are no fine descriptive passages in the Italian text, and in the absence of anything in the nature of word-painting the clouds as objects of beauty are left to speak for themselves.

Correspondence.

To the Editor of Symons's Meteorological Magazine

UNUSUAL HAIL STORM.

On June 12th, 1919, a startling hail storm was experienced six miles to the south from Branxholme. This storm passed north-west in a belt well within two miles in width. At Carlanrig Farm house, 757 feet above sea, at the head of the Teviot river, and situated in the centre of this belt, the hail storm appears to have been at its worst and not much trace of it can be got further south. It commenced about 3.30 p.m., and lasted violently for about five minutes. There was at the time a warm gusty wind from the south, and the hail came with considerable force. The stones were not all shaped alike; but mostly nearly round, of the size of marbles or pigeon's eggs, icy hard, and clear.

Though rounded they cut the stems of plants, and were painful to people. A man who was outside during most of the storm, and who was wearing a cloth cap, had bumps and swellings all over the surface of his head caused by the hail. Cattle got quite distracted, and could not be gathered together. In the farm house about fifty panes of glass were broken. Leaves and twigs were stripped off trees, and garden crops severely damaged.

At Teviothead, shortly after 2 p.m., there was hail for a few minutes, then a lull, and then the blinding shower after 3 p.m. This last covered the ground to the depth of three to four inches. The whole lasted about half an hour. The darkness at this time could almost "be felt." For three miles at least going north-west from Carlanrig, there is the same story of broken glass and damaged gardens. At Teviothead some of the hailstones seemed to have sharp pieces of ice protruding from the ball. A few taken at random and measured were found to be from two to three inches in circumference.

There are reports of hail falling to the north and westward, a dozen of so miles from Teviothead, but apparently ordinary showers not causing damage. JOHN G. WINNING.

Branxholme, 19th June, 1919.

There was very heavy rain in Ayrshire during a severe thunderstorm on June 12th, 1919. I am told 4 inches fell in twelve hours at Knockdon Farm, Maybole. Other places in the district had 2·50 and 3 inches. We had the same thunderstorm here but only 1·02 in. of rain in four and a half hours. It was the worst thunderstorm in this district since August 12th, 1885. R. M. KER

Boghall, Milngavie, Dunbartonshire, June 16th, 1919.

A SEVERE thunderstorm was experienced in this district on Thursday, 12th June, with an exceptional rainfall. The rainfall recorded at Kerse Filters, Patna, was 3·43 in. for the 24 hours ending 9 a.m. of the 13th. Rain came on about 10 a.m. on the 12th, and my gauge showed the fall from then till 6.30 p.m. to be 3 inches.

7, Wellington Square, Ayr, 14th June, 1919. WILLIAM GRAY.

A RAINFALL CONTRAST.

AFTER an excessive rainfall from January to the end of March, we have had a three months' dry spell, which has been more severe than any in my records. Up till June 20th, the drought seems to have been more severe in south-east England, as Atlantic depressions prevented from advancing over England by high pressure over the North Sea, had given occasional slight rainfall to our western and northern coasts. On June 20th, a secondary to one of these gave copious rains to the south of England, about 1·25 in. being recorded in the London area. Our district was, however, too far north-west to be affected by it, only ·22 in. falling. I have never known the ground so dry and the outlook for potatoes and root crops is serious. Hereford, Salop, Monmouth, Radnor and Worcester (or parts of the same) seem to have suffered most. Below is given the fall from January 1st to June 30th, compared with the average :—

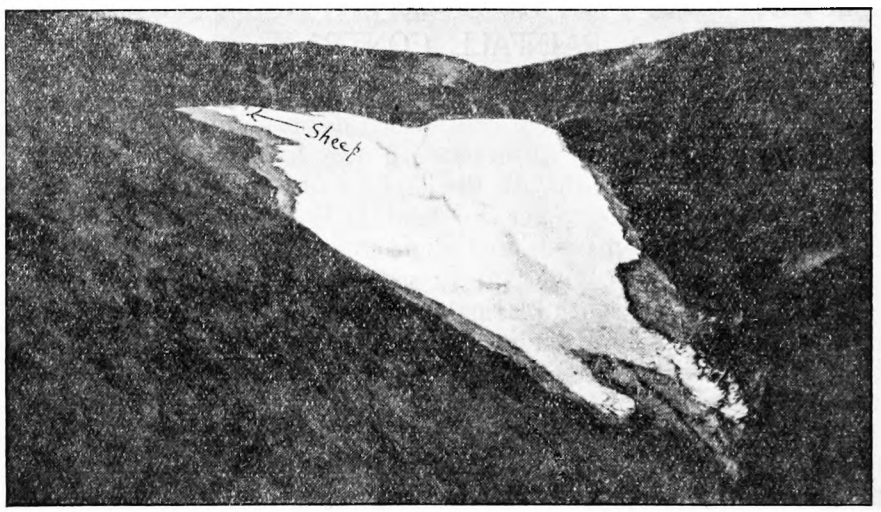
	Rainfall. in.	Excess. in.		Rainfall. in.	Deficit. in.
Jan. ..	3·84	1·36	April ..	1·40	·82
Feb. ..	4·25	1·45	May ..	·37	2·23
March ..	5·80	2·36	June ..	1·00	1·19
Total ..	13·89	5·17		2·77	4·24

In the hot summer of 1911, April, May and June produced as much as 5·37 in., and in 1896, they produced the small total of 3·36 in. Throughout the last three months there has been no absolute drought, rain falling on 8 days in May, and on 12 in June. When the ground is bone dry and sun scorched, rain seems to have no encouragement to fall. I am speaking here only of cyclonic rain. If a drought is broken it seems to require a thunder-plump to do it, unless the air turns cold and cannot hold the moisture so well. On the several occasions on which minute quantities of rain fell in May and June with west-south-west winds, I am convinced that had the ground been thoroughly wet each of these occasions would have produced respectable downpours, the rain required to be met half way so to speak, but failing this, the dark clouds passed over and in a few hours the sun resumed his sway. This is an interesting question which I have never seen discussed, though I am fully persuaded that it is not a theory but an actual fact. R. P. DANSEY.

Kentchurch Rectory, Hereford, July 1st, 1919.

THE SNOWSPOT ON CARNEDD LLEWELYN.

I ENCLOSE a photograph taken on June 3rd by my son of the snow-spot on Carnedd Llewelyn described by me in *British Rainfall 1909* (see pp. 46-53). The length of the bed of snow was forty-five yards, and the greatest width, 10 yards. It was still visible from a distance on June 15th and appeared likely to last till the end of the month.



Considering the full sunshine which the snow actually faced for six weeks, it is a wonder that it lasted so long. The drifts above 2,500 feet on the Snowdonian range were, however, exceptionally large this year. J. R. GETHIN-JONES.

Bryn Awel, St. Mary's Road, Llandudno, June 21st, 1919.

METEOROLOGICAL NEWS AND NOTES.

MR. CARLE SALTER has been awarded the President's premium of the Institution of Water Engineers, for his paper on "The Relation of Rainfall to Configuration," read at the meeting on December 13th, 1918.

THE BRITISH SCIENTIFIC PRODUCTS EXHIBITION at the Central Hall, Westminster, illustrates the great part played by modern science in the prosecution of the war. Lectures on special aspects of the applications of Science to Industry are given at intervals, and a series of kinematograph films of scientific and technical interest is shown on other dates. The latter includes films illustrating, "The Water Powers of Canada and their Industrial Utilization."

MR. C. T. R. WILSON has been appointed Reader in Electrical Meteorology at Cambridge University.

ROYAL METEOROLOGICAL SOCIETY.

A MEETING was held on June 18th, at 70, Victoria Street, S.W., Sir Napier Shaw, F.R.S., President, in the Chair.

A paper by Col. Sir Charles Close, K.B.E., F.R.S., entitled, "Note on the Rainfall at Southampton and London during a period of fifty-seven years (1862-1918)" was read. The form in which statistics are usually published does not readily lend itself to a clear appreciation of the existence of a simple seasonal period. If, after correcting for monthly inequalities, the accumulation of rainfall, reckoning from any fixed date, is tabulated and plotted, the rainfall assumes a more regular aspect. If further, from these monthly figures of accumulation, is deducted the average precipitation, the remaining figures approximate to a simple sine curve, with an annual period. The irregularities left over occur chiefly in September and October.

It would appear that at the places in question the rainfall can be considered to result from uniform precipitation throughout the year, modified by a simple annual harmonic term, further modified by small irregularities in September and October.

A discussion followed in which Mr. Carle Salter showed that an examination of average monthly values at many widely distributed stations exhibited a similar characteristic to that shown by Sir Charles Close. Mr. Giblett stated the results of a harmonic analysis of several records. Mr. J. E. Clark spoke of the effect of thunderstorms on average values for the summer months. Mr. H. E. Carter exhibited the results of hourly duration and amount of rainfall treated as Sir Charles Close had treated monthly values. Sir Napier Shaw spoke of the deviations of monthly values resulting from want of uniformity in the length of the months.

A "Note on Tornadoes," by Lieut. J. Logie, R.A.F., aimed at showing that no convection currents are capable of producing tornadoes of the intensity claimed for some of these storms. The author computed the difference of temperature between the air in the centre of the tornado and that outside. For a tornado having a pressure reduction of 50 millibars at the surface the mean temperature difference was found to be 23°A if the tornado extended to 5 kilometres (16,000 feet), 10°A if it extended to 10k., and 5°A if it extended to 15k. From the known values of the lapse-rate of saturated air it follows that under conditions of maximum instability a saturated ascending current not less than 8k. high might produce a tornado of this intensity. Since such instability rarely occurs, and in addition ascending currents of saturated air are usually everywhere penetrated by descending masses of cooler air, even a tornado of this intensity is unlikely to be so produced in natural conditions. It was suggested that the required rise of temperature may be due to lightning which is usually described as a characteristic of the funnel-cloud.

Lt.-Col. E. Gold quoted Mr. C. T. R. Wilson's results to refute the suggestion that lightning flashes are instrumental in causing the rise in temperature. Lieut. J. S. Turner, Mr. J. S. Dines, Mr. E. C. Barton and Sir Napier Shaw also contributed to the discussion.

A paper by Capt. D. Brunt, R.E., was entitled, "A Periodogram Analysis of the Greenwich Temperature Records." The monthly mean temperatures at Greenwich for the years 1841 to 1890 were represented by a Fourier Series up to 100 terms, to permit of the detection of any periods of length greater than one year. Periods of 9·5, 5 and 4 years, 23 months, and 20 months, were shown to exist, all having amplitudes of the order of 0°·5 F. Many of the periods found were not continuous, *e.g.*, the 20-month period died away about 1894, being replaced by a period of about 23 months. The general result showed that periods in astronomical sense do not exist in these temperature records. The result of correcting the observations for the effect of the periods found produced an almost inappreciable diminution of the standard deviation of the observations, tending to show that variations of the monthly mean temperatures from year to year may be regarded as purely chance variations or as due to periods of length less than a year.

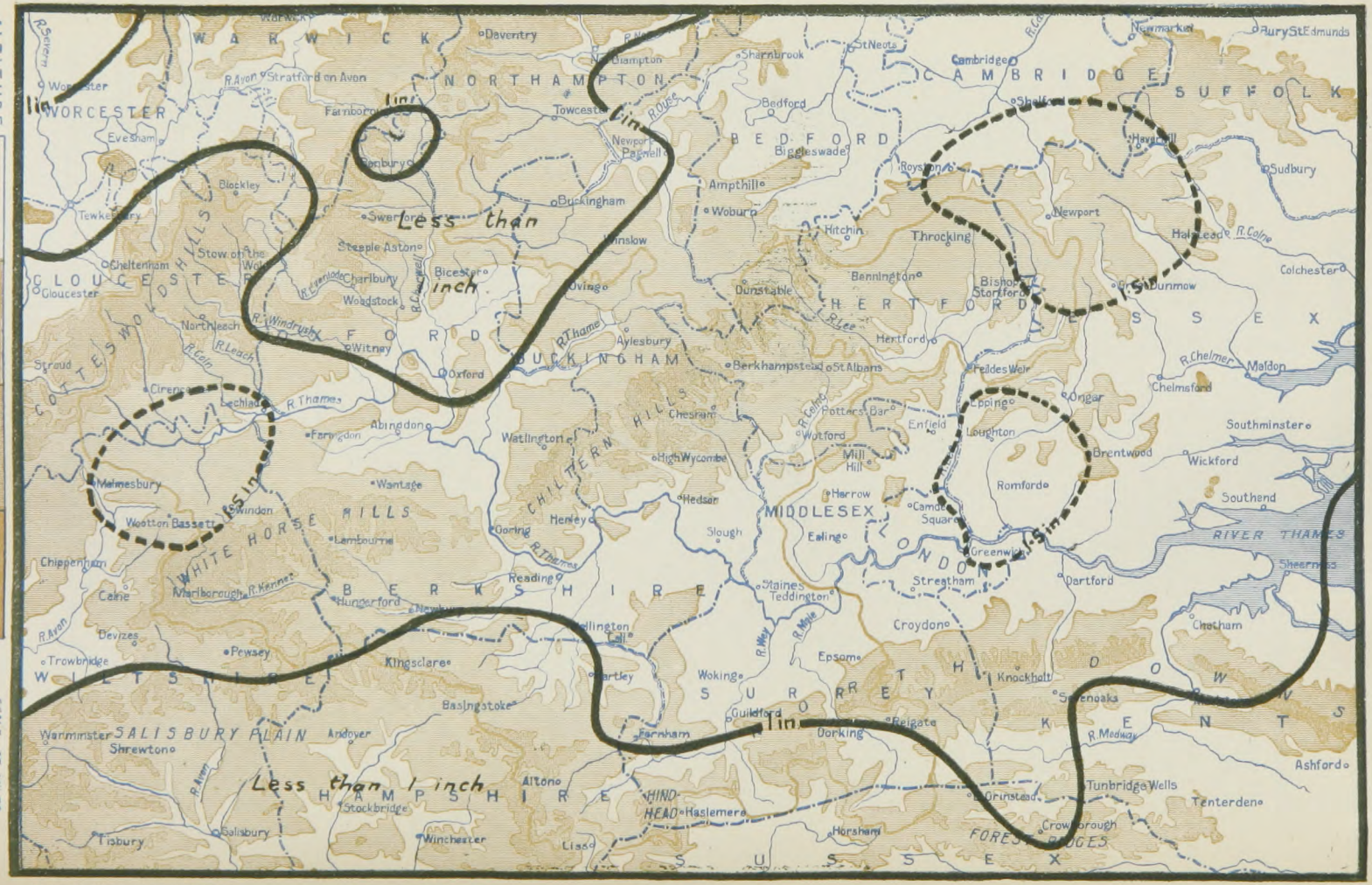
Mr. J. I. Craig, of the Egyptian Survey Dept., said he had found the existence of the nine-year and five-year periods in an investigation of the maximum annual height of the Nile during the past eight hundred years. Mr. C. E. P. Brooks, Mr. F. J. W. Whipple and Mr. W. W. Bryant also spoke.

Lt.-Col. E. Gold presented a summary of a paper by Lieut. E. Green, R.E., "on the Propagation of Sound in the Atmosphere." It contained a theoretical discussion in connection with experimental observations of the velocity of sound under normal atmospheric conditions as regards temperature and wind velocity. Numerical results were added for some interesting cases.

The following candidates were elected Fellows of the Society :— Mr. R. Brenard, Capt. J. Durward, R.E., Capt. C. Frobisher, R.A.F., Dr. W. Gordon, M.A., F.R.C.P., Major R. M. Ker, and Mr. T. Phillips.

A summer meeting of the Society was held on July 2nd, when a large company of Fellows and friends attended the Kew Observatory, Richmond. Mr. R. A. Watson-Watt, gave a demonstration of a portable wireless apparatus for use in the location of distant lightning flashes. Pilot balloon ascents were carried out from the Observatory grounds and Sir Napier Shaw exhibited two diagrams showing the motion of air in travelling depressions. A special exhibition of photographs of clouds and other meteorological phenomena added to the interest of the meeting.

THAMES VALLEY RAINFALL. JUNE, 1919.



Symons's Meteorological Magazine.

Shaded area of River Thames above Teddington and River Lee above Feildes Weir

THE WEATHER OF JUNE.

UNTIL about the 18th, the type of pressure distribution over the major part of the United Kingdon was anti-cyclonic, and the weather was therefore mainly fair and very dry. One or two important exceptions were, however, observed. Thunderstorms occurred in many places on the 1st, and on the two succeeding days, when the prevailing winds were from N. or N.W., the weather was decidedly cool. Ground frost was observed in several districts on the night of the 2nd, the exposed thermometer falling to a minimum of 24° at Greenwich and Rhayader, and to 25° at Wisley. Next day shade maxima below 60° were recorded at a number of stations in the north and east of England; at Cromer and Norwich the thermometer did not rise much above 50°. Another marked exception to the general run of fair weather occurred on the 12th, when Ireland and the west of Scotland were visited by severe thunderstorms and extremely heavy falls of rain, amounting to between 2 and 2½ inches in many places. (*See* letters on pp. 64 and 65 ante). In Ireland and Scotland the thermometer never reached a high summer level, but over a large portion of England shade maxima of 80° and upwards were recorded on at least three occasions, viz.: about the 7th, the 11th and the 16th, the reading at Camden Square (in the Glaisher screen), on the 11th being as high as 85°. In the rear of a depression which passed eastward across Ireland and England between the 11th and 13th, a cold northerly wind sprang up, and on the last mentioned date the thermometer in many places failed to reach 60°; while on the following night a slight ground frost was observed in isolated parts of England and Wales.

Between the 19th and 20th the development of a shallow depression over southern England was attended by copious and very welcome falls of rain in the Home counties; and for the remainder of the month when the prevailing winds were from between north and west the weather was cool, cloudy and rather changeable, though mostly dry. During the closing week there were at least two or three occasions upon which the thermometer over a large portion of the country failed to reach 60°. At some places on the 26th it did not touch 55°, and at night a sharp ground frost was again experienced locally, the exposed thermometer falling to 24° at Greenwich, 26° at Wisley, and 28° at Raunds and Tunbridge Wells.

In most of the western and northern districts the total duration of bright sunshine was below the average, but over the greater part of England, where the second week was extremely fine, there was a general, though not very large, excess.

The total rainfall was generally deficient over England but exceeded the average over a small area in Wales, the whole of the west of Scotland, and all but the southern counties of Ireland. Large areas in the south of England and the Midlands had a total fall under one inch, and practically the whole of England, excluding Wales and the Lake District, had less than 2 inches. A large area in Wales had more than 5 inches, and nearly 1 inches fell on Plinlimon. In Scotland the total ranged from about an inc in the extreme north-east to more than 10 inches west of the Caledonian Canal and nearly 20 inches at Loan. In Ireland, only a small area in Co. Cork had less than an inch, and 4 inches was exceeded at many inland and west coast stations. The general rainfall expressed as a percentage of the average was:– England and Wales, 62; Scotland, 139; Ireland, 105; British Isles, 96.

In London (Camden Square) the partial drought, which had lasted for seven weeks, broke up on the 19th and thereafter the weather was cool and showery. Duration of sunshine 214·3 hours, and of rainfall 27·3 hours. Evaporation 3·39 inches

RAINFALL TABLE FOR JUNE, 1919.

STATION.	COUNTY.	RAINFALL. Aver. 1875—1909. in.	1919. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days
Camden Square	*London*	2·28	1·51	— ·77	66	·85	20	9
Tenterden	*Kent*	2·03	·47	—1·56	23	·39	20	4
Arundel (Patching)	*Sussex*	2·13	·79	—1·34	37	·60	20	5
Fordingbridge (Oaklands)	*Hampshire*	1·93	·92	—1·01	48	·36	20	7
Oxford (Magdalen College)	*Oxfordshire*	2·27	·89	—1·38	39	·24	12	9
Wellingborough (Swanspool)	*Northampn*	2·14	·74	—1·40	35	·29	21	5
Bury St. Edmunds (Westley)	*Suffolk*	2·21	1·26	— ·95	57	·42	20	10
Geldeston [Beccles]	*Norfolk*	1·77	1·26	— ·51	71	·44	20	11
Polapit Tamar [Launceston]	*Devon*	2·18	1·06	—1·12	49	·35	24	10
Rousdon [Lyme Regis]	,,	2·18	·68	—1·50	31	·30	20	6
Ross (Birchlea)	*Herefordshr.*	2·43	1·08	—1·35	44	·43	12	12
Church Stretton (Wolstaston)	*Shropshire*	2·59	1·04	—1·55	40	·47	13	8
Boston	*Lincoln*	1·95	·91	—1·04	47	·23	30	12
Worksop (Hodsock Priory)	*Nottingham*	2·06	·92	—1·14	45	·20	21	16
Mickleover Manor	*Derbyshire*	2·55	1·00	—1·55	39	·36	12	12
Congleton (Buglawton Vic.)	*Cheshire*	2·69	2·36	— ·33	88	·55	12	17
Southport (Hesketh Park)	*Lancashire*	2·26	1·35	— ·91	60	·31	19	13
Wetherby (Ribston Hall)	*York, W.R.*	2·17	·86	—1·31	40	·20	24	10
Hull (Pearson Park)	,, *E.R.*	2·09	·68	—1·41	33	·15	30	13
Newcastle (Town Moor)	*North'land*	2·04	1·48	— ·56	73	·42	22	16
Borrowdale (Seathwaite)	*Cumberland*	6·94	5·86	—1·08	84	...	...	...
Cardiff (Ely)	*Glamorgan*	2·55	1·42	—1·13	56	·67	12	15
Haverfordwest	*Pembroke*	2·74	2·53	— ·21	92	1·16	12	13
Aberystwyth (Gogerddan)	*Cardigan*	2·97	5·02	+2·05	169	2·95	12	15
Llandudno	*Carnarvon*	1·97	1·52	— ·45	77	·39	12	16
Cargen [Dumfries]	*Kirkcudbrt.*	2·84	1·93	— ·91	68	·52	19	16
Marchmont House	*Berwick*	2·38	1·54	— ·84	65	·28	3	13
Girvan (Pinmore)	*Ayr*	3·04	4·37	+1·33	144	2·45	13	16
Glasgow (Queen's Park)	*Renfrew*	2·41	3·48	+1·07	145	1·47	12	18
Islay (Eallabus)	*Argyll*	2·80	5·40	+2·60	193	·84	15	23
Mull (Quinish)	,,	3·30	6·42	+3·12	194	1·15	7	25
Loch Dhu	*Perth*	4·45	4·25	— ·20	96	·80	16	14
Dundee (Eastern Necropolis)	*Forfar*	2·06	1·56	— ·50	76	·26	24	16
Braemar	*Aberdeen*	2·18	1·94	— ·24	89	·50	29	19
Aberdeen (Cranford)	,,	2·02	1·16	— ·86	57	·18	29	18
Gordon Castle	*Moray*	2·13	2·70	+ ·57	127	...	...	...
Drumnadrochit	*Inverness*	2·26	3·11	+ ·85	138	·75	28	22
Fort William	,,	3·77	6·60	+2·83	175	1·27	15	25
Loch Torridon (Bendamph)	*Ross*	4·07	11·79	+7·72	290	1·72	15	23
Dunrobin Castle	*Sutherland*	2·10	1·78	— ·32	85	·33	10	11
Glanmire (Lota Lodge)	*Cork*	2·91	·79	—2·12	27	·19	10, 11	11
Killarney (District Asylum)	*Kerry*	2·92	1·38	—1·54	47	·24	11	18
Waterford (Brook Lodge)	*Waterford*	2·79	1·82	— ·97	65	·66	12	9
Nenagh (Castle Lough)	*Tipperary*	2·70	2·31	— ·39	86	·59	11	16
Ennistymon House	*Clare*	3·18	2·81	— ·37	88	·69	11	20
Gorey (Courtown House)	*Wexford*	2·59	1·58	—1·01	61	·78	12	10
Abbey Leix (Blandsfort)	*Queen's Co.*	2·58	4·48	+1·90	173	2·08	12	16
Dublin (Fitz William Square)	*Dublin*	2·00	3·12	+1·12	156	1·81	12	14
Mullingar (Belvedere)	*Westmeath*	2·72	3·88	+1·16	143	2·18	12	11
Crossmolina (Enniscoe)	*Mayo*	3·17	4·95	+1·78	156	·82	15	20
Cong (The Glebe)	,,	3·18	3·33	+ ·15	105	·57	18	16
Collooney (Markree Obsy.)	*Sligo*	3·11	4·07	+ ·96	131	·52	3	23
Seaforde	*Down*	2·88	3·03	+ ·15	105	1·48	12	16
Ballymena (Harryville)	*Antrim*	2·89	3·15	+ ·26	109	·43	10, 12	17
Omagh (Edenfel)	*Tyrone*	2·82	3·70	+ ·88	131	·57	11	19

SUPPLEMENTARY RAINFALL, JUNE, 1919.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches
II.	Sevenoaks, Speldhurst Close.	1·03	XI.	Lligwy	1·62
,,	Ramsgate	·85	,,	Douglas, Isle of Man	...
,,	Hailsham	·48	XII.	Stoneykirk, Ardwell House...	3·00
,,	Totland Bay, Aston House...	·98	,,	Carsphairn, Shiel	7·04
,,	Stockbridge, Ashley..	·93	,,	Langholm, Drove Road	2·43
,,	Grayshott	·83	XIII.	Selkirk, The Hangingshaw..	1·53
,,	Upton Nervet	·99	,,	North Berwick Reservoir	1·87
III.	Harrow Weald, Hill House...	1·36	,,	Edinburgh, Royal Observaty.	1·70
,,	Pitsford, Sedgebrook	·64	XIV.	Biggar	2·36
,,	Woburn, Milton Bryant	1·40	,,	Maybole, Knockdon Farm ...	5·92
,,	Chatteris, The Priory	1·15	XV.	Shiskine	3·80
IV.	Elsenham, Gaunts End	1·59	,,	Ardgour House	10·92
,,	Rayleigh	1·23	,,	Oban	6·80
,,	Colchester, Hill Ho., Lexden	1·15	,,	Holy Loch, Ardnadam	5·96
,,	Aylsham, Rippon Hall	1·51	,,	Loch Venachar	3·20
,,	Swaffham	1·48	XVI.	Glenquey	3·50
V.	Bishops Cannings	1·34	,,	Loch Rannoch, Dall	2·32
,,	Weymouth	·73	,,	Blair Atholl	...
,,	Ashburton, Druid House	·99	,,	Coupar Angus	1·83
,,	Cullompton	·89	,,	Montrose, Sunnyside Asylum.	·91
,,	Lynmouth, Rock House	1·36	XVII.	Balmoral	2·03
,,	Okehampton, Oaklands	...	,,	Fyvie Castle	2·65
,,	Hartland Abbey	1·28	,,	Keith Station	3·46
,,	St. Austell, Trevarna	·98	XVIII.	Rothiemurchus	3·85
,,	North Cadbury Rectory	1·41	,,	Loch Quoich, Loan	19·80
VI.	Clifton, Stoke Bishop	1·46	,,	Skye, Dunvegan	8·65
,,	Ledbury, Underdown	·95	,,	Fortrose	1·81
,,	Shifnal, Hatton Grange	1·29	,,	Glencarron Lodge	8·67
,,	Droitwich	1·20	XIX.	Tongue Manse	3·56
,,	Blockley, Upton Wold	1·18	,,	Melvich	3·19
VII.	Grantham, Saltersford	·85	,,	Loch More, Achfary	8·40
,,	Louth, Westgate	·64	XX.	Dunmanway, The Rectory	1·01
,,	Bawtry, Hesley Hall	·81	,,	Mitchelstown Castle	1·28
,,	Derby, Midland Railway	·77	,,	Gearahameen	3·20
VIII.	Nantwich, Dorfold Hall	1·88	,,	Darrynane Abbey	1·53
,,	Bolton, Queen's Park	1·29	,,	Clonmel, Bruce Villa	2·65
,,	Lancaster, Strathspey	1·97	,,	Roscrea, Timoney Park	3·97
IX.	Langsett Moor, Up. Midhope	·63	,,	Broadford, Hurdlestown	2·81
,,	West Witton	·85	XXI.	Enniscorthy, Ballyhyland...	2·96
,,	Scarborough, Scalby	1·19	,,	Rathnew, Clonmannon	1·14
,,	Ingleby Greenhow	1·50	,,	Hacketstown Rectory	2·83
,,	Mickleton	·20?	,,	Ballycumber, Moorock Lodge	3·37
X.	Bellingham, High Green Manor	1·70	,,	Balbriggan, Ardgillan	2·55
,,	Ilderton, Lilburn Cottage	1·06	,,	Castle Forbes Gardens	2·62
,,	Keswick, The Bank	3·22	XXII.	Ballynahinch Castle	5·47
,,	Orton	2·44	,,	Woodlawn	2·66
XI.	Llanfrechfa Grange	·89	,,	Westport House	2·80
,,	Treherbert, Tyn-y-waun	3·73	,,	Dugort, Slievemore Hotel	6·51
,,	Carmarthen, The Friary	2·45	XXIII.	Enniskillen, Portora	3·16
,,	Fishguard, Goodwick Station.	2·72	,,	Dartrey [Cootehill]	4·43
,,	Crickhowell, Tal-y-maes	1·50	,,	Warrenpoint, Manor House	2·67
,,	Birmingham WW., Tyrmynydd	3·32	,,	Belfast, Cave Hill Road	2·36
,,	Lake Vyrnwy	...	,,	Glenarm Castle	2·94
,,	Llangynhafal, Plas Drâw	3·69	,,	Londonderry, Creggan Res...	3·81
,,	Rhiwbryfdir	6·52	,,	Milford Manse	3·66
,,	Dolgelly, Bryntirion	5·37	,,	Killybegs	4·27

Climatological Table for the British Empire, January, 1919.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, CamdenSquare	54·3	15	25·1	23	42·6	33·1	35·5	91	74·0	21·1	3·22	22	7·8
Malta	64·4	2, 3	40·0	21	59·3	50·9	...	90	112·0	41·0	3·59	18	7·5
Lagos	97·0	3	73·0	1	82·8	73·4	74·6	77	147·2	73·0	·12	3	7·3
Cape Town	87·1	19	53·0	9	78·2	59·6	55·3	62	...	...	·98	7	3·4
Johannesburg	84·5	15	50·9	19	76·6	57·4	57·2	80	...	52·8	4·78	17	6·0
Mauritius	94·8	15	68·5	2	89·9	73·3	71·1	74	...	65·2	5·76	16	6·3
Bloemfontein	92·8	12	51·3	29	87·3	59·6	56·4	57	..	...	2·87	10	3·7
Calcutta...	83·4	12	49·4	17	78·2	58·9	58·6	72	...	38·5	·58	1	4·6
Madras	87·4	30	64·5	2	85·3	72·1	70·0	78	155·6	61·2	·37	1	3·6
Colombo, Ceylon ...	91·8	16	65·9	12	88·0	73·0	71·1	77	162·6	58·1	4·33	12	5·0
Hongkong	78·4	10	46·8	3	65·4	58·6	...	81	...	...	·63	11	8·5
Sydney	97·9	21	58·8	18	80·1	65·5	60·4	63	152·0	51·9	1·55	10	5·2
Melbourne	...	...	...	...	...	...	...	...	...	...	...	...	...
Adelaide	106·3	5	51·6	25	85·7	60·4	51·5	44	167·0	41·3	·33	2	3·0
Perth	98·0	25	54·6	28	81·2	61·5	58·4	65	159·6	49·0	·26	2	2·7
Coolgardie	111·8	22	56·8	2*	95·1	63·0	49·2	31	170·2	56·0	·17	2	2·0
Brisbane	94·6	26	63·6	12	86·6	69·5	64·8	66	158·1	58·9	·32	3	4·4
Hobart, Tasmania ..	87·8	2	42·6	26	69·4	51·4	45·4	54	154·9	38·9	2·05	14	5·8
Wellington ...	71·8	28	43·5	12	65·2	55·4	52·0	74	143·0	32·1	3·74	10	7·1
Jamaica, Kingston ..	88·9	20	65·3	5	85·7	69·4	67·6	78	...	...	2·17	8	3·8
Grenada	85·0	Sev.	70·0	Sev.	83·0	72·0	...	73	137·0	...	2·81	17	2·5
Toronto	46·9	22	0·5	10	36·6	21·9	22·4	81	115·6	—4·8	1·04	13	6·8
Fredericton	41·0	22	—16·0	28	30·7	12·3	14·3	76	48·0	...	1·75	8	...
St. John, N.B. ...	46·3	2	—12·5	12	30·6	14·7	17·0	79	114·2	—13·0	5·61	16	6·7
Victoria, B.C.	52·0	13	33·0	30	45·0	37·6	39·0	89	99·0	23·0	5·81	16	7·8

*6 and 25.

Johannesburg.—Bright sunshine 252·0 hours.

COLOMBO, CEYLON.—Mean temp. 80°·5, or 1°·6 above, dew point 1°·5 above, and R 1·04 in. above, averages. Mean hourly velocity of wind 4·2 miles. TSS on 5 days. Storm on 31st with 1·70 in. of R.

HONGKONG.—Mean temp. 61°·5. Bright sunshine 81·8 hours. Mean hourly velocity of wind 13·8 miles.

Sydney.—R below average. Very severe T and H storm on 19th.

Adelaide.—Mean temp. 1°·0 below, and R ·39 in. below, averages.

Perth.—R ·08 in. below average.

Coolgardie.—Temp. 1°·7 above, and R about ·30 in. below, averages.

Brisbane.—Temp. slightly above, and R below, averages for 12th successive month.

Wellington.—Mean temp. same as average, and R ·45 in. above average. Bright sunshine, 179·5 hours. Weather unsettled, with strong N.W. winds.

Symons's

Meteorological Magazine.

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THE BRITISH RAINFALL ORGANIZATION AND THE METEOROLOGICAL OFFICE.

At the annual meeting of the Trustees of the British Rainfall Organization on July 23rd, 1919, an agreement with the Director of the Meteorological Office was signed which marks an important step in the co-ordination of the meteorological services of the country.

Dr. H. R. Mill, who has been the unpaid Director of the British Rainfall Organization since January 1st, 1901, when he joined Mr. H. Sowerby Wallis, who retired in 1903, had presented the accumulated rainfall records, the instruments at 62, Camden Square, and other property, to Trustees in 1910 to be held for the public benefit, reserving the right to use the records and the services of the assistants in his professional work as a rainfall expert. On the breakdown of his eyesight in 1913, Dr. Mill took a long holiday, and, on returning to this country, in 1914, he was making arrangements for retiring when the war broke out and he postponed the step until a more convenient season. As the result of an accident last year his health was further impaired, and he has now resigned the directorship of the Organization and has given up his professional work and all engagements, except the membership of the Board of Trade Committee on the Water Power Resources of the United Kingdom, which he hopes to retain until the final report of the Committee is prepared. The Trustees in the circumstances considered that the time was favourable for giving effect to a plan which had often been under consideration, whereby the cordial relations of the Organization and the Meteorological Office should be made still closer, to the advantage of both, and the furtherance of meteorological science. It has accordingly been arranged that from July 24th the Meteorological Office should assume

responsibility for the work of the British Rainfall Organization, taking over the custody of the records, the services of the staff, and occupying the offices at 62, Camden Square, which have been leased to the Government by the Trustees. With the sanction of H.M. Treasury, Sir Napier Shaw, on the part of the Meteorological Office, undertakes to continue the annual issue of "British Rainfall" and the monthly publication of *Symons's Meteorological Magazine* on their present lines, so far as these may not be modified by future expansion and improvement.

Mr. Salter, who has been joint-Director with Dr. Mill for the last year, and whose connection with the Organization goes back to the time of Mr. Symons, the founder, has been appointed Superintendent in charge of the rainfall work, which will be carried on without interruption at the old address.

In consideration of the property transferred, the Government has paid over to the Trustees a sum sufficient to allow them to purchase an annuity for Dr. Mill as an equivalent for the rights retained by him under the Trust Deed, which he has now relinquished.

The Trustees are satisfied that the course they have followed is the best possible in the circumstances and they believe that the prestige of a unified national meteorological service will enable a fuller development of rainfall research than would have been possible under private management, while the flexibility and vitality of the voluntary system of observing is safe-guarded by the retention of the old staff under Mr. Salter.

RETIREMENT OF DR. H. R. MILL.

To the Readers of "Symons's Meteorological Magazine."

With the arrangement of the contents of this number my editorship of this Magazine comes to an end, but the Magazine will, I trust, go on its way to ever-growing importance. I have been responsible for 222 numbers which have been issued since February 16th, 1901, allowing for some months in 1913 and 1914, when I was on the other side of the world. Until the war made the mere maintenance of existence an aim worth striving for, I endeavoured to the best of my ability to make each number better than the one before, and I am sure that my successor will do no less.

To the regular readers, and especially to those who have kept our correspondence pages filled and overflowing for fifty-four years with experience and criticism, I wish to record my grateful thanks. I would also thank the staff of the British Rainfall Organization, on whom has fallen the burden of routine work, the perfect performance of which is attested by the punctuality of the appearance of this Magazine. In particular I must record my great indebtedness, especially in recent years, to Mr. Salter, who

has always assisted me and often taken my place in the editorial work. No editor was ever better served by printers and engravers than I have been by Messrs. Shield and Spring, whose press has produced every number of this Magazine, and by Messrs. Bale, Sons and Danielsson, who have produced all the illustrations for the last nineteen years.

I take leave of all with the utmost regret, but not before I have seen provision made for a future of wider usefulness for this Magazine than my impaired health could possibly allow me to secure for it by retaining control. The times demand a fresh outlook and a vigorous grasp of new ideas and impending developments in the science and the practice of meteorology, and I confidently hope that *Symons's Meteorological Magazine* will at last shake off the limitations of the past and find its true place in the sun.

John Hopkinson, F.L.S., F.G.S.

1844—1919.

We learn with regret of the death on July 5th of Mr. John Hopkinson, of Watford, at the age of 74. Mr. Hopkinson was a familiar figure to all who were in the habit of attending scientific meetings in London, and his interests were very wide. He edited for more than forty years the Transactions of the Hertfordshire Natural History Society, including rainfall tables for the county, and was Secretary from 1875-91 and President in 1891-93. He was for many years a member of the Council, and was a past Vice-President, of the Royal Meteorological Society, and he established the well-equipped meteorological observatory at the Herts. County Museum at St. Albans, taking much trouble in arranging for its continuance after his death. In 1899, Mr. Hopkinson became Treasurer of the Rae Society, dealing with natural history in the widest sense and his later years were devoted largely to work on their publications. He wrote numerous papers on scientific subjects, being specially interested in natural history and geology, whilst his associateship of the Institution of Civil Engineers spoke of a lively interest in the practical application of scientific knowledge to economic purposes. In this connection it may be noted that he was a recognized authority on the underground water in the chalk.

As an Observer of many years standing to the British Rainfall Organization, and especially in his capacity as collector of local rainfall records for Hertfordshire, Mr. Hopkinson was always ready to extend courteous help to us in our work, and the loss of his genial co-operation will be severely felt.

Walter Gould Davis.

1851—1919.

We regret to announce the death on April 30th, at Danville, Vermont, U.S.A., of Mr. W. G. Davis, the well known Argentine meteorologist and director of the National Weather Bureau of Argentina from 1885 to 1915. Originally trained as a civil engineer Mr. Davis, in the early seventies, joined his uncle, Dr. Gould, of the Cordoba Astronomical Observatory, and on the retirement of the latter was appointed director of the newly established meteorological section, which at that time consisted of less than twenty stations. Under Mr. Davis the service rapidly developed and on his retirement the number of meteorological stations had increased to nearly two hundred, with ten times as many rainfall stations. In 1901 the central office was removed from Cordoba to Buenos Aires, and Mr. Davis was thereby enabled to carry out a scheme for the production of a daily weather map on a comprehensive scale, co-operation with other South American States resulting in a map extending from the Equator to the Straits of Magellan. The rainfall data contained in the 8 a.m. map were based on returns telegraphed from 1,350 points, probably a unique achievement in rapid mapping of meteorological data upon an extended scale. In 1902 Mr. Davis established the hydrometric section of the Argentine Meteorological Office, and soon after all the principal rivers and lakes were under observation. A magnetic observatory was established in 1904, from which magnetic surveys were from time to time organized. In the same year Mr. Davis took over the sub-Antarctic station in the South Orkneys, founded the year previous by the *Scotia* Antarctic Expedition, and in 1905 absorbed into his service for the continuation of this work the staff of the Ben Nevis Observatory, which had then been recently closed.

Mr. Davis was elected a member of the International Meteorological Committee in 1894, and an Honorary Fellow of the Royal Meteorological Society in 1898.

His contributions to meteorology are contained in thirteen quarto volumes of the "Anales" of the Oficina Meteorológica Argentina. He also wrote three works on the "Climate of the Argentine Republic," published in 1889, 1902 and 1910 respectively, and a general summary of his thirty years' labour in 1914, under the title "History and Organization."

As a director, Mr. Davis enjoyed the respect and appreciation of the executive officials through many changes of Government, while his generous gift of friendship and undeviating amiability endeared him to his whole staff down to the humblest messenger in the service. R.C.M.

Correspondence.

To the Editor of Symons's Meteorological Magazine

SNOWFALL AROUND THE SPRING EQUINOX.

I DO not know whether Mr. Preston is right in ascribing a special tendency to snowfall in the week immediately about the Equinox, but there is certainly a great tendency for snowfall in the British Isles throughout the month of March and even April, that is to say, during the spring or equinoctial period. In fact on general climatic experience without having made a statistical investigation I should say that in quite five English Marchs out of ten snow is a more common precipitate than rain, and it commonly comes in the form of bitter squalls of very pure dry flakes indeed. Snow is about as common round the spring equinox as it is round the winter solstice and the explanation of the anomaly is not difficult. Not only is the mean temperature in our maritime northern country slower to rise in spring than in continental regions in the same latitude, but this tendency is enhanced by the frequency with which the pressure distribution at that season favours a flow of air from Polar regions. Thus it often happens that a mild, open, rainy winter is followed by a rather dry and frosty spring in which snowfall figures more prominently than rainfall; and it is certainly true to say that we are very liable in England to experience an Atlantic winter followed by an Arctic spring.

An interesting feature to note in connection with spring snowfalls is this: that snow showers are apt to occur in spring with considerably higher maximum day temperatures than in winter and for the following reason. In March during a cold northerly type the actual surface air temperature in sunny intervals between snow squalls may rise to between 40° and 50° F., that is to say the actual temperature in what is *potentially* a very cold wind may be locally quite high; whereas in December or January a temperature between 40° and 50° F. signifies a mild type of weather, with what I might be permitted to call a high potential temperature, in which conditions only rain can fall. L. C. W. BONACINA.

27, Tanza Road, Hampstead, N.W. 3, June 20th, 1919.

LOW JULY MAXIMUM.

THE maximum temperature here to-day was 52°·7 F., probably the lowest maximum recorded for a century for July 20th in the south of England. At Greenwich the lowest maximum for this date was 58°, in 1902.

The lowest maximum at Greenwich for any day in July since 1841 was 55°·9, on July 12th, 1888.

The maximum temperature to-day was equal to the mean maximum of March 29th and November 4th, at Greenwich.

As the *minimum* temperature of to-day was 50°·7, the diurnal range was only 2°, which is very remarkable.

H. K. G. ROGERS.

"*Glenart*," *Weybridge, July 20th, 1919.*

[Dr. H. R. Mill reports a maximum reading of 52°·1 on the same day at Dorman's Park, Surrey, at 320 feet above sea-level. This reading was made in the evening and would have been lost if the maximum temperature had been taken at 9 a.m. next day, when the thermometer stood at 59°·1. Mr. Rogers's station is at an altitude of 85 feet and Greenwich, 150 feet.—ED., *S.M.M.*].

A RAINFALL CONTRAST.

MR. DANSEY's interesting communication shows that an excess of rain in January, February and March of 5·17 in. was followed by a deficit in April, May and June of 4·24 in. There is an old saying,

"Never a debt is paid so nigh
As the wet will pay the dry."

In view of the above figures might we not also say.

"Better paid was never debt
Than the dry will pay the wet.'

A.F.

Failand, near Bristol.

SNOW FOLLOWING FINE WEATHER.

By M. A. GIBLETT, B.Sc.

WITH reference to the correspondence in the issues of this magazine for March, April and May of this year, concerning the occurrence of snow following a soft warm day in the latter part of February or in March, I have, at the suggestion of Mr. J. S. Dines, endeavoured to obtain some estimate of the frequency of occurrence of snow following closely on a period of high maximum temperature. In the accompanying table is given the result of examining the weather reports sent in daily to the Meteorological Office during the period from mid-February to the end of March in the ten years 1910-1919. Included in the table are (*a.*) the number of periods of consecutive days on which the maximum temperature of a selected station in the Midlands, reached 50°F., (*b.*) the number of these occasions which

were followed within 3 days by snow in the part of England south of about Spurn Head; (*c.*) the total number of periods of consecutive days on which snow fell in that part of England.

Mid-February to End of March	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	Total 1910 to 1914	Total 1915 to 1919	Total 1910 1 1
(*a.*) Number of periods with maximum of 50°F. or more at inland station	6	6	7	5	8	6	6	2	6	4	32	24	56
(*b.*) Number of occasions on which snow followed within 3 days	3	2	2	3	6	5	4	2	2	3	16	16	32
(*c.*) Total number of periods of snow	5	3	2	4	6	6	4	3	2	6	20	21	41

The totals for the first five years are in fair agreement with those for the latter five. The ten-year totals for (*a.*) and (*b.*) show that snow followed within three days on 57 per cent. of the occasions on which there was a period with a maximum temperature of at least 50°F., while from (*b.*) and (*c.*) we see that these occasions of snow formed 78 per cent. of the total number of periods of snow. Thus more than three-quarters of the occasions of snow occurred within three days after a period of high maximum temperature. This appears to afford a striking confirmation of the statement made by Dr. C. P. Hooker.

An examination of the weather maps shows that these phenomena cannot be attributed to any one definite sequence of changes in the pressure distribution. The period of high maximum temperature seems to occur either in the rear of an anticyclone which is moving eastwards as a depression advances from the Atlantic, or with the winds of the S.W. quadrant in the right front of a depression moving in a track north of the station.

In the first case, if the depression takes a southerly track the snow may occur with the north or north-east winds in its rear, while if, as in the second case, the track taken is to the north of the station, then the snow occurs either in the north or north-west winds in the rear of the depression, or more frequently in the rear of small secondaries or depressions which subsequently pass eastwards across the south of England. The occasion of March 10th, mentioned by Dr. Hooker, in his letter in the May issue, affords an illustration of the last type. The maximum of 55° F. occurred while a depression was situated to the north-west of Ireland. This depression subsequently moved north-eastwards to Scandinavia, while a secondary passing from west to east across the south of England was accompanied by snow in its rear on the 12th.

AMALGAMATION OF METEOROLOGICAL SERVICES.

It is announced by *The Times* that a scheme for the amalgamation of the existing Government Meteorological Services has been approved, and details are being arranged. Under the stress of war conditions the Meteorological Office was supplemented by the addition of three specially organized services, respectively in charge of the Admiralty, the Army and the Air Ministry, and the coming of peace thus found four more or less overlapping departments. The present scheme brings them together under the directorship of Sir Napier Shaw, who has acted for some time past in the capacity of Meteorological Adviser to the Government. The new amalgamated service will meet the requirements of the Army, Navy, Royal Air Force, of civil aviation, fisheries, engineering, and of all others who require meteorological information. It will be in close touch with all colonial and foreign observatories, and will bring together information from all parts of the world.

The department will come under the Controller-General of Civil Aviation and the headquarters will most probably be at the Air Ministry, though it is understood that the expenses will not come into the Air Estimates, being met by a special grant.

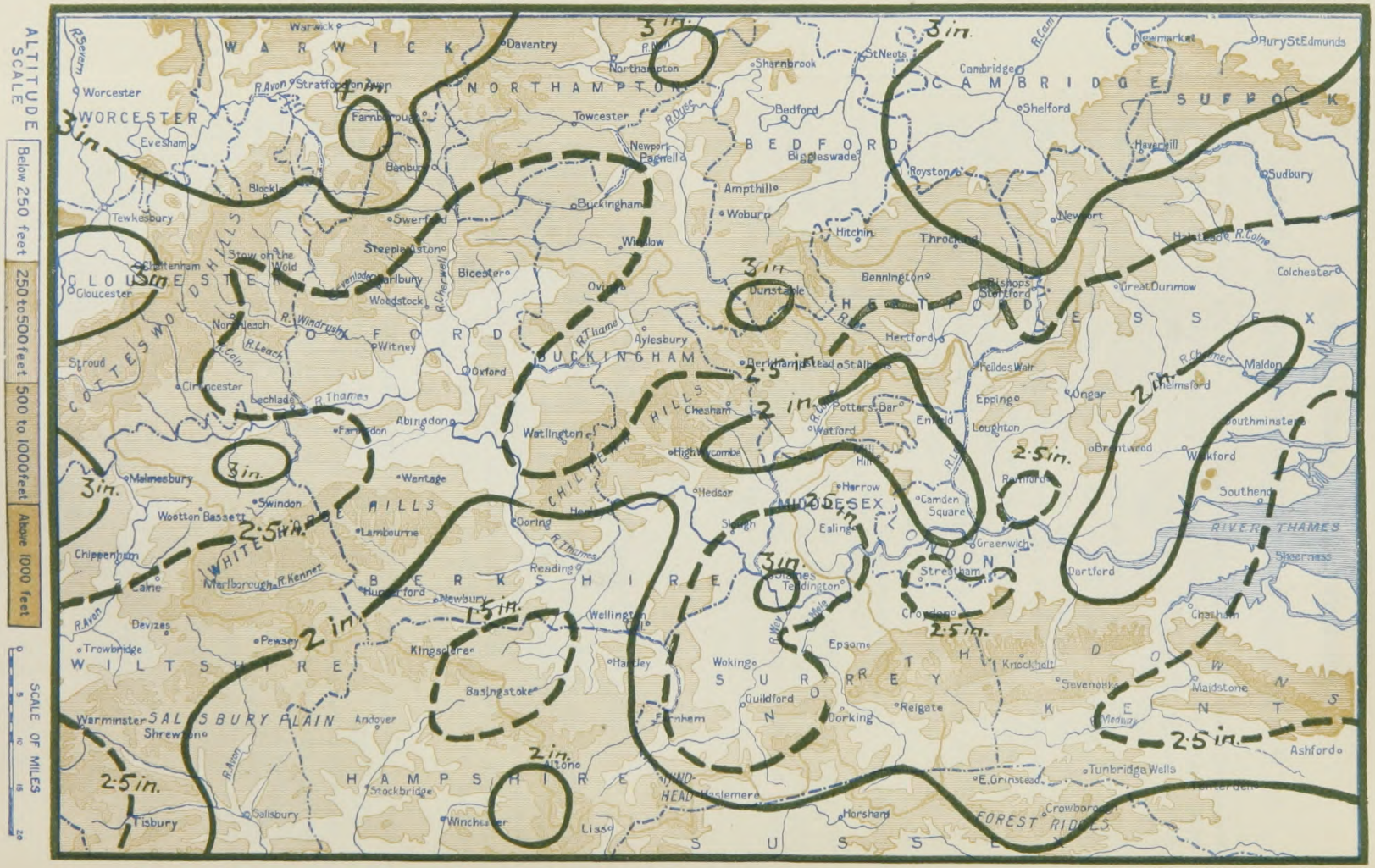
METEOROLOGICAL NEWS AND NOTES.

British Rainfall, 1918, is now in the hands of the printers and it is hoped that it will be possible to issue it somewhat earlier than in the last two years. Any Observers whose records have not yet been sent in should post them immediately to 62, Camden Square, N.W. 1, in order that they may be inserted in the proofs before passing them for press.

A Cornwall Rainfall Association has been formed for the purpose of stimulating rainfall reading in the county, and held its first meeting at Falmouth, on July 16th. The Association proposes to work for the establishment of new stations, to inspect rain gauges and bring together records for publication, and will operate in informal association with the British Rainfall Organization. All who are interested in these objects should communicate with the Hon. Secretary, Mr. A. Pearce Jenkin, of Trewirgie, Redruth.

Peace Day, July 19th, was marked by exceptionally heavy rainfall in parts of the English Midlands, and we learn that during the twenty-four hours, ending at 9 a.m. on the 20th, 2·45 in. had fallen at Gloucester and 2·04 in. at Sheffield.

THAMES VALLEY RAINFALL. JULY, 1919.



THE WEATHER OF JULY.

THROUGHOUT the greater part of last month there was a constant proclivity for an extension northwards of the anticyclonic system which is centred, in an ordinary July, over the Azores region. As a result the prevailing winds in this country were not merely of oceanic origin, but came from high latitudes, more often than not from the northward or north-westward, and in some few instances from the north-eastward. The mean temperature of the month was consequently below the average, and especially so over eastern and central England. At Kew Observatory the mean of the daily maximum temperatures, 65°·0, was 6° below the average, and was lower than in any July since 1888. In the same neighbourhood the mean of the night temperatures (the shade minima) was the lowest observed in a record extending back to 1871.

During the first 5 days of the month a shallow barometical depression moved slowly southwards over England and the North Sea and occasioned very cool winds from N., varying to N.E., thunderstorms being experienced in several parts of England and Ireland between the 2nd and 4th. Between the 6th and 8th the nights were very cold, with slight ground frost locally in the west and north. An anticlyclone afterwards spread over the country from the north-westward, and on the 10th and 11th the thermometer over a large portion of Great Britain rose to between 75° and 80°. Later on the anticyclone withdrew in a south-westerly direction and cool winds from W. and N.W. set in, frost being experienced in Scotland on the nights of the 12th and 13th; on the grass the thermometer sank to 26° at Crathes and 27° at Balmoral.

On the 18th the wind in the front of an advancing depression backed temporarily to S.W. or S. and the thermometer rose slightly above 75° in many parts of England. The depression afterwards moved eastward directly across the United Kingdom and occasioned heavy rain in many districts. In its rear the wind shifted to N.W. and N. and a great fall of temperature took place over England, the maximum reading, at Kew, on the 20th (54°), being 23° lower than that of the 18th. At the close of the month, when the wind backed to W. or S.W., the thermometer rose briskly, and on the 31st it exceeded 75° in the east and south-east of England.

The total duration of bright sunshine exceeded the average in the west and north, but was considerably below it in the eastern and central districts. In a normal July the amount of sunshine at Falmouth is not appreciably greater than at Kew; last month the western station enjoyed twice as much as the metropolitan Observatory.

Rainfall was as a rule deficient, being remarkably so in parts of the east of Scotland and of Ulster. Less than an inch fell widely in these districts. All parts of Scotland and Ireland had less than the average rainfall, and this was also the case in the greater part of Wales and in parts of England, but belts of relatively high rainfall stretched across England and Wales between Dartmoor on the south-west, and the east coast from Yorkshire to Norfolk on the north-east. A number of patches in the Midlands had more than 3 inches, the total rising to more than 4 inches in places. This amount also fell locally in the mountains of Wales. The general rainfall for England and Wales was 74 per cent. of the average, for Scotland 36 per cent., and for Ireland 45 per cent., the fall for the British Isles as a whole being 55 per cent. of the average.

In London (Camden Square) the weather was dull and cool with the exception of a few days, mostly in the middle of the month. The mean temperature 59°·3 was 4°·2 below the average and the lowest for July in the 62 years' record excepting 1879 (59°·1) and 1888 (58°·9). Duration of sunshine 108·9 hours, and of rainfall 49·1 hours. Evaporation 1·90 inches.

Printers' error in June, line 45; *for* nearly 1 *read* nearly 15.

RAINFALL TABLE FOR JULY, 1919.

STATION.	COUNTY.	RAINFALL. Aver. 1875–1909. in.	1919. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days
Camden Square	*London*	2·57	1·75	— ·82	68	·30	11	14
Tenterden	*Kent*	2·21	1·71	— ·50	77	·38	12	15
Arundel (Patching)	*Sussex*	2·46	1·87	— ·59	76	·65	19	13
Fordingbridge (Oaklands)	*Hampshire*	2·14	1·67	— ·47	78	·57	19	11
Oxford (Magdalen College)	*Oxfordshire*	2·43	2·15	— ·28	88	·74	19	12
Wellingborough	*Northampn*	2·54	2·23	— ·31	88	·54	12	12
Bury St. Edmunds (Westley)	*Suffolk*	2·68	3·97	+1·29	148	1·33	20	18
Geldeston [Beccles]	*Norfolk*	2·37	2·63	+ ·26	111	·55	11	18
Polapit Tamar [Launceston]	*Devon*	2·74	·98	—1·76	36	·19	21	13
Rousdon [Lyme Regis]	,,	2·68	2·42	— ·26	90	·97	19	10
Ross (Birchlea)	*Herefordshr.*	2·75	2·69	— ·06	98	1·20	19	14
Church Stretton (Wolstaston)	*Shropshire*	2·58	*2·74*	+ ·16	106	·48	2	*14*
Boston	*Lincoln*	2·35	2·50	+ ·15	106	·62	11	17
Worksop (Hodsock Priory)	*Nottingham*	2·35	2·40	+ ·05	102	·76	19	12
Mickleover Manor	*Derbyshire*	2·57	2·34	— ·23	91	·77	19	12
Congleton (Buglawton Vic.)	*Cheshire*	3·03	2·19	— ·84	72	·42	19	14
Southport (Hesketh Park)	*Lancashire*	2·92	1·48	—1·44	51	·36	3	9
Wetherby (Ribston Hall)	*York, W.R.*	2·56	2·77	+ ·21	108	·76	19	10
Hull (Pearson Park)	,, *E.R.*	2·39	1·94	— ·45	81	·38	19	14
Newcastle (Town Moor)	*North'land*	2·90	1·60	—1·30	55	·48	2	10
Borrowdale (Seathwaite)	*Cumberland*	8·91	3·75	—5·16	42	...	...	...
Cardiff (Ely)	*Glamorgan*	3·26	1·77	—1·49	54	·66	19	11
Haverfordwest	*Pembroke*	3·39	·78	—2·61	23	·37	17	9
Aberystwyth (Gogerddan)	*Cardigan*	4·03	2·62	—1·41	65	·69	21	11
Llandudno	*Carnarvon*	2·52	1·35	—1·17	54	·45	21	13
Cargen [Dumfries]	*Kirkcudbrt.*	3·20	1·36	—1·84	43	·77	31	4
Marchmont House	*Berwick*	3·30	·62	—2·68	19	·15	2	8
Girvan (Pinmore)	*Ayr*	3·73	1·09	—2·64	29	·72	31	6
Glasgow (Queen's Park)	*Renfrew*	2·91	·73	—2·18	75	·41	30	4
Islay (Eallabus)	*Argyll*	3·41	2·26	—1·15	66	·94	18	9
Mull (Quinish)	,,	4·12	1·86	—2·26	45	·73	18	15
Loch Dhu	*Perth*	4·69	2·50	—2·19	53	1·00	18	6
Dundee (Eastern Necropolis)	*Forfar*	2·84	·69	—2·15	24	·30	18	5
Braemar	*Aberdeen*	2·65	·49	—2·16	19	·24	18	3
Aberdeen (Cranford)	,,	3·00	1·03	—1·97	34	·37	21	10
Gordon Castle	*Moray*	3·25	·59	—2·66	18	...	...	...
Drumnadrochit	*Inverness*	3·37	·92	—2·45	27	·28	21	8
Fort William	,,	4·92	1·56	—3·36	32	·63	31	8
Loch Torridon (Bendamph)	*Ross*	5·35	2·44	—2·91	45	·58	30	11
Dunrobin Castle	*Sutherland*	2·91	1·41	—1·50	48	·45	19	6
Glanmire (Lota Lodge)	*Cork*	2·73	1·37	—1·36	50	·56	4	8
Killarney (District Asylum)	*Kerry*	3·53	2·42	—1·11	69	·57	18, 20	15
Waterford (Brook Lodge)	*Waterford*	3·13	1·51	—1·62	48	·44	18	10
Nenagh (Castle Lough)	*Tipperary*	3·02	1·63	—1·39	54	·61	18	9
Ennistymon House	*Clare*	3·57	2·14	—1·43	60	·51	4	12
Gorey (Courtown House)	*Wexford*	2·90	1·08	—1·82	37	·36	5	6
Abbey Leix (Blandsfort)	*Queen's Co.*	2·99	1·78	—1·21	59	·65	21	10
Dublin (Fitz William Square)	*Dublin*	2·60	1·13	—1·47	43	·45	21	11
Mullingar (Belvedere)	*Westmeath*	3·16	1·26	—1·90	40	·40	17, 20	7
Crossmolina (Enniscoe)	*Mayo*	3·26	1·46	—1·80	45	·43	21	13
Cong (The Glebe)	,,	3·72	...	...	...	...	...	...
Collooney (Markree Obsy.)	*Sligo*	3·36	1·99	—1·37	59	·66	13	14
Seaforde	*Down*	3·32	·40	—2·92	12	·31	18	5
Ballymena (Harryville)	*Antrim*	3·44	1·05	—2·39	31	·32	18	8
Omagh (Edenfel)	*Tyrone*	3·34	·82	—2·52	25	·40	18	7

SUPPLEMENTARY RAINFALL, JULY, 1919.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches
II.	Sevenoaks, Speldhurst Close.	2·14	XI.	Lligwy	1·61
,,	Ramsgate	2·87	,,	Douglas, Isle of Man	...
,,	Hailsham	1·37	XII.	Stoneykirk, Ardwell House...	·52
,,	Totland Bay, Aston House...	...	,,	Carsphairn, Shiel	1·50
,,	Stockbridge, Ashley	1·73	,,	Langholm, Drove Road	1·16
,,	Grayshott	1·64	XIII.	Selkirk, The Hangingshaw..	·57
,,	Upton Nervet	1·47	,,	North Berwick Reservoir	·88
III.	Harrow Weald, Hill House...	2·28	,,	Edinburgh, Royal Observaty.	·63
,,	Pitsford, Sedgebrook	2·51	XIV.	Biggar	·71
,,	Woburn, Milton Bryant	3·44	,,	Maybole, Knockdon Farm ...	·76
,,	Chatteris, The Priory	2·52	XV.	Shiskine	1·55
IV.	Elsenham, Gaunts End	2·49	,,	Ardgour House	3·44
,,	Rayleigh	1·93	,,	Oban	1·45
,,	Colchester, Hill Ho., Lexden	2·11	,,	Holy Loch, Ardnadam	2·35
,,	Aylsham, Rippon Hall	3·31	,,	Loch Venachar	1·65
,,	Swaffham	2·98	XVI.	Glenquey	1·90
V.	Bishops Cannings	2·32	,,	Loch Rannoch, Dall	·33
,,	Weymouth	2·17	,,	Blair Atholl	...
,,	Ashburton, Druid House	1·38	,,	Coupar Angus	·51
,,	Cullompton	1·46	,,	Montrose, Sunnyside Asylum.	·58
,,	Lynmouth, Rock House	1·09	XVII.	Balmoral	·34
,,	Okehampton, Oaklands	1·71	,,	Fyvie Castle	1·22
,,	Hartland Abbey	1·04	,,	Keith Station	...
,,	St. Austell, Trevarna	·78	XVIII.	Rothiemurchus	...
,,	North Cadbury Rectory	2·68	,,	Loch Quoich, Loan	5·90
VI.	Clifton, Stoke Bishop	2·84	,,	Skye, Dunvegan	2·93
,,	Ledbury, Underdown	2·85	,,	Fortrose	·44
,,	Shifnal, Hatton Grange	2·60	,,	Glencarron Lodge	1·90
,,	Droitwich	3·16	XIX.	Tongue Manse	·77
,,	Blockley, Upton Wold	3·00	,,	Melvich	·69
VII.	Grantham, Saltersford	4·29	,,	Loch More, Achfary	2·99
,,	Louth, Westgate	2·76	XX.	Dunmanway, The Rectory	1·36
,,	Bawtry, Hesley Hall	2·80	,,	Mitchelstown Castle	1·76
,,	Derby, Midland Railway	2·66	,,	Gearahameen	3·50
VIII.	Nantwich, Dorfold Hall	1·79	,,	Darrynane Abbey	1·74
,,	Bolton, Queen's Park	1·84	,,	Clonmel, Bruce Villa	1·36
,,	Lancaster, Strathspey	1·21	,,	Roscrea, Timoney Park	1·56
IX.	Langsett Moor, Up. Midhope	...	,,	Broadford, Hurdlestown	2·23
,,	West Witton	2·15	XXI.	Enniscorthy, Ballyhyland...	1·30
,,	Scarborough, Scalby	2·94	,,	Rathnew, Clonmannon	·80
,,	Ingleby Greenhow	3·52	,,	Hacketstown Rectory	1·49
,,	Mickleton	1·70	,,	Ballycumber, Moorock Lodge	1·25
X.	Bellingham, High Green Manor	1·41	,,	Balbriggan, Ardgillan	·66
,,	Ilderton, Lilburn Cottage	1·01	,,	Castle Forbes Gardens	1·13
,,	Keswick, The Bank	1·49	XXII.	Ballynahinch Castle	1·78
,,	Orton	1·73	,,	Woodlawn	2·20
XI.	Llanfrechfa Grange	1·89	,,	Westport House	1·28
,,	Treherbert, Tyn-y-waun	1·60	,,	Dugort, Slievemore Hotel	...
,,	Carmarthen, The Friary	1·41	XXIII.	Enniskillen, Portora	·71
,,	Fishguard, Goodwick Station.	·91	,,	Dartrey [Cootehill]	·61
,,	Crickhowell, Tal-y-maes	1·00	,,	Warrenpoint, Manor House	·54
,,	Birmingham WW., Tyrmynydd	1·74	,,	Belfast, Cave Hill Road	·68
,,	Lake Vyrnwy	1·12	,,	Glenarm Castle	·48
,,	Llangynhafal, Plas Drâw	2·65	,,	Londonderry, Creggan Res...	1·42
,,	Rhiwbryfdir	3·07	,,	Milford Manse	...
,,	Dolgelly, Bryntirion	2·79	,,	Killybegs	...

ERRATUM.—June, 1919, at Llangynhafal, Plas Drâw, *for* 3·69 *read* 2·59.

Climatological Table for the British Empire, February, 1919.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	51·7	22	15·4	9	41·0	30·5	33·4	93	82·6	13·3	2·64	14	8·1
Malta	69·4	18*	44·0	14	60·4	51·0	...	84	121·5	42·5	1·19	12	2·9
Lagos	91·3	24	72·5	8	89·5	77·5	78·3	82	162·4	65·2	2·74	4	6·4
Cape Town	103·4	5	54·0	24	80·9	62·6	58·3	65	...	...	1·56	6	3·6
Johannesburg	89·9	8	47·2	4	77·6	56·5	54·0	74	...	44·4	3·33	8	4·7
Mauritius	89·2	4	70·3	4	86·8	74·0	71·2	76	...	65·3	5·71	13	6·0
Bloemfontein	95·8	7	46·4	26	88·0	58·5	54·6	50	..	...	·48	4	3·1
Calcutta...	87·3	27	52·4	4	82·1	60·3	57·4	63	...	41·4	1·16	1	2·5
Madras	93·5	18	68·4	23	87·7	71·4	69·5	74	160·1	65·2	·00	0	2·8
Colombo, Ceylon ...	91·8	5†	69·0	7	89·7	73·6	71·6	76	162·5	61·7	·34	5	4·2
Hongkong	72·5	27	39·4	4	61·7	55·0	51·8	79	...	...	1·51	8	7·5
Sydney	97·4	18	57·1	2	81·1	66·4	63·1	67	148·8	52·0	5·26	10	4·9
Melbourne	106·6	15	51·2	1	81·8	60·5	56·4	60	151·0	42·0	3·65	5	3·9
Adelaide	105·1	14	54·8	20	86·7	64·9	57·1	52	162·8	46·0	2·68	6	3·8
Perth	103·0	23	49·4	16	82·7	60·9	55·7	58	166·3	41·0	·90	3	2·9
Coolgardie	107·2	26	50·8	17	92·8	62·6	51·1	37	171·0	49·0	·26	2	3·2
Brisbane	93·1	20	65·0	3	87·1	69·0	67·1	71	156·9	60·7	·89	6	4·4
Hobart, Tasmania ..	82·3	2	45·0	24	71·8	55·5	52·6	67	139·2	39·0	1·51	8	6·7
Wellington	81·1	24	44·9	26	69·6	56·9	54·9	75	152·0	31·6	2·02	3	5·4
Jamaica, Kingston ...	91·5	19	62·6	13	87·0	69·1	66·8	77	...	...	·34	3	2·2
Grenada	88·0	13	70·0	21	83·0	73·0	...	72	137·0	...	1·90	9	2·5
Toronto	52·7	28	10·2	11	34·9	21·7	20 9	79	96·0	3·0	1·82	12	5·9
Fredericton	38·8	2	−19·0	7‡	25·3	5·7	11·3	83	...	...	4·37	13	6·5
St. John, N.B. ...	39·5	22	5·3	11	30·7	18·4	16·0	76	122·0	4·2	1·84	9	5·3
Victoria, B.C.	50;9	14	27·0	24	44·5	35·6	36·0	85	110·0	19·0	2·75	18	7·5

* and 19. † 6 and 11. ‡ 11 and 12.

Johannesburg.—Bright sunshine 233·8 hours.

COLOMBO, CEYLON.—Mean temp. 81°·6, or 2°·0 above, dew point 1°·3 above, and R 1·62 in. below, averages. Mean hourly velocity of wind 3·3 miles. TS8 on 10th and 11th. Prevailing direction of wind was N.W.

HONGKONG.—Mean temp. 58°·0. Bright sunshine 90·6 hours. Mean hourly velocity of wind 12·3 miles.

Melbourne.—Mean temp. 3°·8 above, and R 1·66 in. above, averages; 3·77 in. of R fell in 24 hours on 17th-18th, a record for a day's fall during 63 years.

Adelaide.—Mean temp. 1°·7 above, and R 2·26 in. above, averages. The wettest February in 81 years' record.

Perth.—R ·44 in. above average.

Coolgardie.—Temp. 1°·7 above, and R ·50 in. below, averages.

Brisbane.—Temp. above, and R below, averages.

Wellington.—Mean temp. 63°·2 or 0°·9 above, and R 1·25 in. below, averages. Bright sunshine, 179·1 hours. Two sunless days.

Symons's Meteorological Magazine.

No. 644. SEPTEMBER, 1919. Vol. LIV.

EDITORIAL.

That the present number of *Symons's Meteorological Magazine* appears without the familiar name of Hugh Robert Mill upon its cover will, we are sure, be a source of deep regret to our readers. For nearly twenty years Dr. Mill has impressed his stimulating personality on this magazine which was brought into being more than half a century ago by the late Mr. G. J. Symons, and which has since his death, in 1900, helped to keep his memory green.

Dr. Mill's nearly twenty years of directorship of the British Rainfall Organization has formed a fitting sequel to the forty years of single-minded and persevering industry by which Mr. Symons had built up a scientific instrument unique of its kind. The great ability and boundless energy of the founder were expended principally upon the work of organization and administration in which his genius chiefly lay. Upon the material which he accumulated Dr. Mill brought to bear a deep scientific insight, combined with that rare faculty for clear demonstration which imparted a peculiar charm to his work. The key to the clearer understanding of rainfall distribution, and the factors which govern it, has been the use of cartographical methods, and a study of the volumes of *British Rainfall* from 1901 onwards in comparison with those of earlier years shows how methodically and successfully this has been developed. Much which Dr. Mill designed to do is, as yet, unfinished, but this at least may be said, that he has shown how the dry bones of statistics may be vitalized by the exercise of scientific imagination, and has thus brought home to thousands the beauty of natural truths in a manner that few investigators have succeeded in doing.

The war, and possibly even in a greater degree, the general trend of thought, have brought us to the time when a closer co-ordination of scientific work has become essential if the greatest good is to be derived from the efforts of all workers. Dr. Mill's retirement occurs at the moment when unification in the meteorological services of the country, the successful carrying out of which he worked hard

and made great personal sacrifices to further, has been secured. In our last number we published, on the authority of *The Times*, a statement of the formation of the new Meteorological organization which has been brought into being under the directorship of Sir Napier Shaw. In the present number we are glad to be able to supplement this statement with an article by Lt.-Col. E. Gold, one of the most eminent pioneers of modern meteorology, setting out some of the aspirations which now promise to come within the range of practical realization. That the British Rainfall Organization will play its part in the shaping of the new meteorological world we have the fullest confidence. The kindly and willing co-operation of the several thousand voluntary helpers will, we feel certain, be so fully maintained, that the organization cannot fail to prove one of the chief corner-stones of British climatology.

For ourselves, the tradition of Dr. Mill's fine example will never fail to be an incentive to carry on worthily the work which he loved so well. CARLE SALTER.

UNIFICATION OF THE BRITISH METEOROLOGICAL SERVICES.

By Lt.-Col. Gold, D.S.O., F.R.S.

A famous general of the Flying Corps once remarked that, whatever may have been his opinion about the policy of an Allied Supreme Command, he was fully convinced that a single meteorological service was the correct policy for the Western Front. Full inter-allied meteorological unity was never, indeed, achieved, but there was, in the field, a national unity in favourable contrast with the trinities in Paris and London; and there was the closest co-operation between the French, British and American Military Meteorological Services.

With the end of the war the movement for unity gained power, and now at last the British Isles have one Meteorological Service with an establishment of personnel and equipment more in accordance with the importance of the science than the pre-war establishment; which corresponded rather with the humility induced in its devotees by the study of meteorology.

This unification and expansion means for meteorologists increased opportunities and responsibilities; it does not mean a meteorological millenium in which all difficulties of administration vanish and the secrets of isobaric charts stand revealed. Some of the opportunities will present themselves directly, others will only come as a consequence of diligence and research; and at times the meteorologist may have to abandon the policy of waiting for the

opportunity to force him to take it, and adopt instead the policy of seeking the opportunity in spite of the disappointments which inevitably meet the seeker in the barren lands that border on the fertile gardens of his hope.

The British Rainfall Organization became part of the new service on the 24th July—the one hundred and second anniversary of the birth of Sir Richard Strachey—a day of good omen. How can general meteorology and the study of British rainfall both be advanced by the undoubted advantage of the new situation, and to such an extent as to dissipate the fears of stagnation at Headquarters and of alienation of sympathy in the great army of volunteer Observers? In the first place the great collection of records of rainfall can take its place in British climatology and a new edition of "Rainfall Tables of the British Isles" can be issued with monthly and seasonal maps; perhaps, indeed, with ten-day maps, and with the frequency of rainfall days and rainfall duration adequately treated as well as the distribution between night and day. In the second place the study of orographic distribution of rainfall can be taken a step further, by considering it more closely in relation to other meteorological factors such as wind direction; and both orographically and generally the distribution of rainfall requires discussion in relation to the distribution of pressure and temperature. In this connection the "nœuds" or small areas in which the barometric tendency at times exhibits peculiarities should receive special consideration. Finally an opportunity will present itself shortly for securing either international standards of exposure, measurement and publication, or, such an international series of comparisons as will render the rainfall statistics of different countries intercomparable.

By the amalgamation of the Army, Navy and Air Force Meteorological Services with the parent Meteorological Office, the new Service will be able to combine the teachings of meteorological history with the endeavour to secure simplicity and definiteness in meteorological language, codes and phenomena. But it will also have unparalleled opportunities for developing the three-dimensional study of the atmosphere. Given a knowledge of the isobaric distribution at the surface and the temperature distribution at all heights, the supplementary information derived from observations of the wind at all heights will permit the extent of the differences from steady motion to be computed; and the definition of a "disturbance" may take a new form and new light be thrown on the irregularities in the progress and character of disturbances as we know them at present.

Although there are never observations enough, yet there is always a danger of the meteorologist being swamped by the observations and records which pour in upon him: the danger is an increasing one as also is the tendency to regard observations as things of the

moment, to be thrown away or filed for ever, immediately the forecaster has done with them. If the new Service is successful in dealing with this problem its contribution to our knowledge of climate in and above the British Isles, will be a more enduring monument than the apparently ephemeral achievement of an accurate forecast.

Finally, British meteorology is inseparable from the Ocean : the pressing need for economizing our stores of accumulated energy make it desirable that the meteorology of the ocean should be put on a footing from which it can announce the energy practically available in the winds, the rate at which it can be supplied on any route and the routes on which the maximum per mile can be attained. Warnings of gales, ice and fog do not represent the only way in which the meteorology of the sea can contribute to the national welfare ; but the effective use of the existing and increasing statistics of marine meteorology depends on a close liaison between the meteorologist, the shipping company and the sailor. With a "meteorologist in every port," this ought now to be practicable.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

UNUSUAL RAINBOW.

I saw a curious rainbow phenomenon last evening which I have never seen before. It was about 7.30 p.m. (summer time), and clearing after a sharp thunderstorm. A fine rainbow developed, especially bright in its northern limb, with the usual faint repetitions inside the main bow and reversed secondary bow outside. The curious thing was a branch of the main bow. This consisted of an arc of a circle of somewhat larger radius than the main bow, which appeared to spring from it about 5° above the visible horizon, which was itself perhaps 15° above the real horizon. The circle of which this branch was an arc was not concentric with the rest of the scheme, but evidently had its centre 15° to 20° higher, and if complete would have appeared as a horse-shoe arch, such as is seen in Moorish architecture. It, however, faded away above where the spectral band widened out considerably so that it looked like a comet's tail. It was not so bright as the main bow, but brighter than the reversed bow. We could not see the western sky where the sun was sinking into the sea, but my theory is that the effect was caused by the reflection of the sun on the sea acting as a secondary source of light.

J. H. FRYER, M.D., CAPT., R.A.M.C.

51st General Hospital, Etaples, B.E.F., 11th May, 1919.

ABSOLUTE DROUGHT.

AN absolute drought prevailed here from July 23rd to August 17th (both dates inclusive) a period of twenty-six days. This has only once been exceeded and then by only one day, viz., in July, 1911. Owing presumably to the north—south, instead of the normal south-west—north-east track of depressions, the west of England enjoyed considerably higher day temperatures in July than did the London district. At Kew the mean maximum is given in your last issue as 65°·0; here in was 68°·7. On July 20th, with a maximum at Kew of 54°, and of only 52°·1 at Dormans Park, Surrey, the reading here was as high as 66°. These are unscreened shade temperatures; in a screen my readings would have been slightly higher still.

R. P. DANSEY.

Kentchurch Rectory, Hereford, August, 1919.

SNOW AFTER FINE WEATHER.

I HAVE worked out the last eight years with the following result :—

	February 15th—March 21st.		
Year.	Warm Days.	Days with Snow following.	Total days with Snow.
1912	23	1	2
1913	13	2	3
1914	12	0	3
1915	10	2	4
1916	4	0	15
1917	2	2	8
1918	19	0	2
1919	3	2	10
Eight years	86	9	47

This shows that snow following warm days is not very marked, especially in warm springs, like 1912 and 1918.

H. NOWELL FFARINGTON.

Leyland Auxiliary Climatological Station, Lancs., 1st September, 1919.

RAINFALL CONTRAST.

HERE is another version of the old weather saying, which seems to be a better one than that suggested by A. F. in the August number of your magazine :—

> "Never was paid a surer debt,
> Than wet to dry—and dry to wet."

T.S.M.

Basset Down, August 21st, 1919.

RAIN DAYS AND SUMMER SHOWERS.

During June we had a number of showers which seemed to be wetting, but measured very little in the rain gauge. On some of these when one would naturally have spoken of a "wet day," the gauge failed to show ·005 in. I have two gauges side by side, a standard "Snowdon" pattern of galvanized iron, and a copper "British Association" pattern with shallow funnel. On two occasions the latter showed a "rain day" when the former did not. I believe the reason to be that the deep funnel of the Snowdon has a larger surface which must be wetted before the water runs down, and from which evaporation can take place. It also has a larger receiving bottle. Possibly the different specific heats of the materials of which the two gauges are made (iron, ·1138, copper, ·0951) may have an effect. This would favour evaporation from the iron gauge. I have little doubt that in winter these showery days would have been "rain days." For other differences between these two gauges I would refer to my letter in this Magazine, vol. **49,** (1914), p. 18. The rim of the Snowdon is 14½ inches above the ground, and that of the British Association gauge, 10 inches.

Swinton, Berwickshire. A. E. SWINTON.

NOTES ON THE CLIMATE OF MESOPOTAMIA.

By C. H. E. Ridpath.

The climate of Mesopotamia is unique, not, of course, for its shade temperatures of 120° and over, but rather it is the long period of such high temperatures in summer and the spells of cold in winter that make the climate noteworthy.

From about May to September the prevailing wind, known as the Shimral, is north-west. This wind is very persistent during the Indian Monsoon, being part of that system. Dust storms and "dust-devils" of a fairly violent nature occur, but, generally speaking, the wind attains a gusty force, 2 to 4, during the day and dies down at night. In the summer the air is intensely dry, relative humidities under 10 per cent. often being registered. The scorching effect of such a wind at 110° or 120° is therefore intense, yet at the same time the very rapid evaporation of perspiration in one's clothes gives a local but very chilling effect. This dry air, however, inevitably and happily results in comparatively cool nights. The highest minimum in Baghdad in the summer of 1918 was 87°·2, but usually it varied from 75° to 80°. In this connection it is interesting to note how one adapts one's standard of temperatures to prevailing conditions. For instance, one would start playing tennis in the "cool" of the late afternoon when the temperature had sunk to 100° or 95° !

If possible, of course, one sleeps in the open, but the amount of sleep will depend on the goodwill of the sandflies, who are ingeniously designed to get through a mosquito net. Fortunately, a light breeze is sufficient considerably to limit their activities.

It is one long blaze of sun the whole summer. Unfortunately, I have no solar temperature readings before me, but they must be in the region of 170° or 180°. Sunrise in the desert is a wonderful time of beautiful, soft colouring and a freshness in violent contrast to the dazzling glare and fierce heat of the day. The temperature rises rapidly : by 8 a.m., for instance, flying is no longer possible, as engines would seize up. Travelling in trains is forbidden after noon. Even at that hour conditions are not very pleasant in vans with corrugated iron roofs. I remember once having to travel over the desert in a Crossley car rather early in the afternoon, about 4.30 p.m. The engine was running quite normally and we were on top speed, yet the water was boiling within twenty minutes.

The temperatures given in the following table are those taken in a standard Stevenson screen on the roof of the British Residency at Baghdad, beside the left bank of the Tigris. The height above ground level would be about 60 feet, so records are possibly on the low side.

The summer of 1917 had been intensely hot. Amongst many high temperatures the absolute maximum was 122°. The following rainy season however, continued until May, 1918, being about six weeks over the usual time. The Arabs predicted a cool summer, and I am reliably informed the summer I am going to describe was a cool one.

							Days with Max. Shade Temp.					
	Mean			Lowest	Highest	Abs.		90°	100°	110°		Wind
1919.			Abs.				Under	to	to	to	Max.	Max.
Month.	Max.	Min.	Max.	Max.	Min.	Min.	90°	99°	109°	120°	Range	Mileage
MAY...	93·2	68·1	102·9	76·0	73·0	52·5	10	15	6	—	—	321
JUNE...	101·9	75·5	113·6	88·8	85·6	67·6	2	8	14	6	38·3	400
JULY..	109·2	80·2	117·9	98·4	87·2	71·6	—	1	12	18	39·0	358
AUG....	108·0	78·0	116·2	92·3	87·1	70·1	—	3	14	14	37·0	395
*SEPT..	107·1	76·0	113·3	102·7	80·9	72·4	—	—	10	3	35·0	275

							Nights			
1918							Frost	Under 40°		
DEC. ...	59·6	39·3	74·0	50·0	50·0	25·0	5	14	35·0	
1919										
JAN. ...	59·7	40·2	70·0	50·0	54·0	33·0	—	16	28·0	
FEB. ...	63·0	42·7	71·9	56·3	51·4	35·9	—	7	30·0	
MARCH	68·2	48·3	79·9	60·5	56·5	42·8	—	—	26·0	
APRIL.	77·2	56·5	86·2	58·3	65·4	50·4	—	—	26·0	

* The first 13 days only.

(To be continued).

REVIEW.

Sobre Els Vents Estivals De Convecció à La Costa Catalana. E. Fontseré. Barcelona, 1918. Size, 10½ by 8. Pp. 64. 46 illustrations.

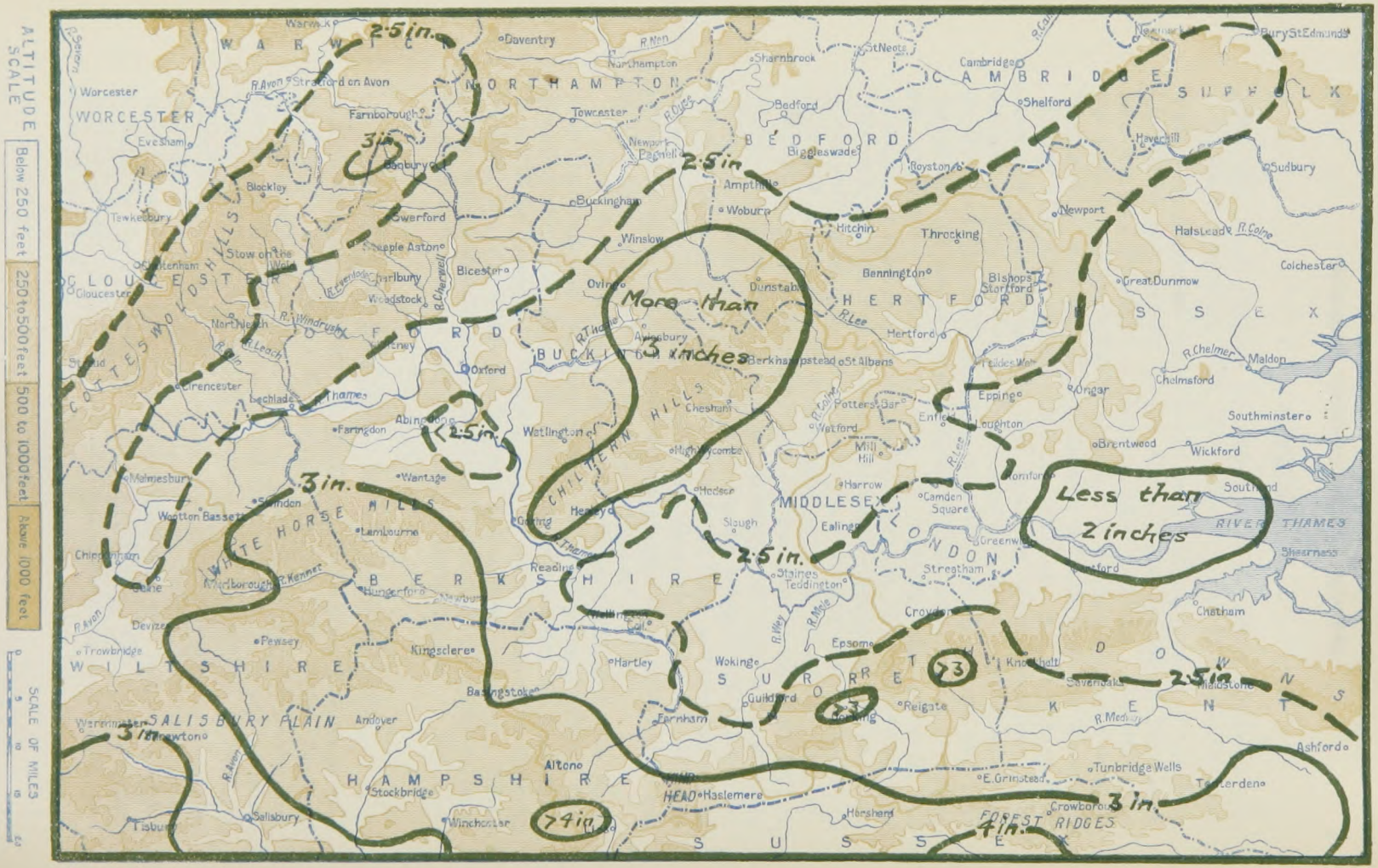
THIS is an important study of the land and sea breezes of Catalana written by the Director of the Aeronautical Station of Barcelona, who is also a Professor of the Faculty of Sciences. Unfortunately the work is written in the local dialect so we cannot pretend to have mastered its contents. The discussion is divided into three sections dealing with observatinos made in Barcelona, supplementary data from the adjacent district, and again in special localities. The services of over thirty volunteer Observers were enlisted, who sent in the data required according to plan. At Barcelona the land breeze sets in during anticyclonic weather after sunset, reaching its maximum velocity at 5 a.m. A complete calm succeeds, but at 8 a.m. the sea-breeze sets in feebly becoming quite marked an hour later and attaining its maximum strength during the hottest hours of the early afternoon. A table is given showing the alternation of land and sea-breezes in 15-day groups, from March to October. The frequency steadily rises from 31 per cent. in the first half of March to 91 per cent. in the last fortnight of July, when it again diminishes, falling to 35 per cent. in the second half of October. A number of maps show the incidence of land and sea breezes at various points and different altitudes along the coast for different hours of the day, with numerous photographic illustrations of clouds of the cumulus type taken at short intervals.

It is to be hoped that this work will be translated into some other languages as an inspection of the illustrations indicates that the results obtained during the investigation are novel and important. It might be possible to make a shot at some of the more striking of these, but it is better not to guess in the present instance, but to await some authorative translation or abstract of the results of what seems to have been a well thought out investigation. R.C.M.

METEOROLOGICAL NEWS AND NOTES.

A CONFERENCE of Meteorologists of the British Dominions will be held in London on September 23rd to 27th. The following have intimated their intention to be present :—Capt. A. J. Bamford, Ceylon; Lt.-Col. D. C. Bates, New Zealand; Mr. H. A. Hunt, Commonwealth of Australia; Mr. H. Knox Shaw, Egypt; Mr. C. Stewart, Union of South Africa; Sir F. Stupart, F.R.S.C., Dominion of Canada; and Dr. G. T. Walker, C.S.I., F.R.S., India. The programme includes visits to the Meteorological Office, the radio-telegraphic stations of the Air Ministry, Kew Observatory, the Meteorological Service of the Admiralty, the British Rainfall Organization and Benson Aerological Observatory.

THAMES VALLEY RAINFALL AUGUST 1919.



Symons's Meteorological Magazine

Watershed of River Thames above Teddington, and River Lee above Feildes Weir

Isohyetals

WEATHER OF AUGUST.

THE opening days of August were marked by a changeable westerly type of weather, but with a temperature somewhat above the average. On the 2nd the thermometer at many places in the south-east of England rose to between 75° and 80°, and on the night of the 4th, it failed to sink as low as 55°. On the 1st a violent dust storm is reported to have occurred at Catterick, (Yorks).

After the 4th the distribution of pressure became distinctly anticyclonic, and between the 5th and 15th a spell of brilliant summer weather was experienced, the thermometer over a large portion of England rising on several successive days to a maximum of 80° and upwards. The warmest weather occurred between the 9th and 12th, when a number of places recorded shade readings slightly above 85°. During the week ended August 16th between 75 and 80 per cent of the possible duration of bright sunshine was registered at many stations in the east and south-east of England, and as much as 83 per cent. at Worthing. In the London district (as represented by the three stations Westminster, Kew and Bunhill Row), the percentage of sunshine during this brilliant period had been exceeded in only 5 calendar weeks of the previous 38 years, the highest proportion (82 per cent.) occurring in the first week of May in 1909.

After the middle of the month a change to a cool westerly and south-westerly type of weather set in, at first in the north, and afterwards over the country generally. In the southern districts the conditions remained for a time under the partial influence of the anticyclone which was retreating southwards, but in the closing week the weather was everywhere cool and very unsettled, with occasional heavy falls of rain in nearly all districts. Between the 25th and 27th, when the centre of a rather deep cyclonic system moved slowly north-eastwards, across Ireland and Scotland, large amounts of rain were experienced in the far north, and the wind rose to a gale on many parts of our coasts—from S.W. to W. in the south, but from N. and N.E. in the north of Scotland. On the 27th and 28th a well defined secondary depression passed north-eastwards across England, while on the 29th, another small secondary was developed over our southern counties, each disturbance being accompanied by heavy rains over a large portion of England and by thunderstorms in places.

In the Meteorological Office Monthly Fly-sheet, it was remarked, "In August, as in the two preceding months, the rarity of thunderstorms formed a continuing feature in a summer which was characterized in other respects by a large amount of disturbed weather."

The total duration of bright sunshine in August was in most places above the normal, but the excess was nowhere very large.

The total rainfall exceeded the average in the south of England, the west and north of Scotland, and in County Waterford, but the excess was nowhere as much as 50 per cent. of the average. Elsewhere the fall was below the average, the deficiency amounting to 58 per cent. at Braemar. Scattered areas along the east coast and a large area south of the Grampians had a total fall under 2 inches. Practically the rest of Great Britain south of the Moray Firth had from 2 to 4 inches, except the mountain areas. On Dartmoor and in South Wales large areas had more than 5 inches, and this amount fell over nearly the whole of the west of Scotland. Several stations in the Lake District had more than 10 inches and about 15 inches fell on Snowdon, at Loan (W. Inverness) and at Loch More (Sutherland). Rather more than 2 inches fell over the central portion of Ireland, the fall increasing to 4 inches in the west and north and to more than 8 inches in the mountains of Connemara. The general rainfall, expressed as a percentage of the average, was as follows :—England and Wales, 85 ; Scotland, 86 ; Ireland, 81 ; British Isles, 86.

In London (Camden Square) the temperature exceeded 80° in the shade on ten consecutive days, from 6th to 17th. Mean temperature, 64°·6 or 2°·3 above the average. Duration of sunshine, 204·7 hours, and of rain, 37·7 hours. Evaporation, 2·78 inches.

RAINFALL TABLE FOR AUGUST, 1919.

STATION.	COUNTY.	RAINFALL. Aver. 1875—1909. in.	1919. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Date.	No. of Days
Camden Square	*London*	2·39	2·37	— ·02	99	·75	28	11
Tenterden	*Kent*	2·42	3·52	+1·10	145	·95	28	13
Arundel (Patching)	*Sussex*	2·52	3·59	+1·07	142	·71	27	11
Fordingbridge (Oaklands)	*Hampshire*	2·76	2·90	+ ·14	105	·93	27	11
Oxford (Magdalen College)	*Oxfordshire*	2·44	2·90	+ ·46	119	·62	28	13
Wellingborough	*Northampn*	2·36	2·30	— ·06	97	·90	28	10
Bury St. Edmunds (Westley)	*Suffolk*	2·52	2·50	— ·02	99	·82	28	13
Geldeston [Beccles]	*Norfolk*	2·22	1·61	— ·61	73	·59	28	11
Polapit Tamar [Launceston]	*Devon*	3·17	2·61	— ·56	82	·58	27	13
Rousdon [Lyme Regis]	,,	2·84	4·10	+1·26	144	1·61	27	14
Ross (Birchlea)	*Herefordshr.*	2·90	2·03	— ·87	70	·49	27	14
Church Stretton	*Shropshire*	...	2·65	...	...	·81	19	10
Boston	*Lincoln*	2·39	2·58	+ ·19	108	·71	25	11
Worksop (Hodsock Priory)	*Nottingham*	2·55	2·25	— ·30	88	·81	28	14
Mickleover Manor	*Derbyshire*	2·80	2·04	— ·76	73	·64	27	10
Congleton (Buglawton Vic.)	*Cheshire*	3·52	3·39	— ·13	96	·62	26	17
Southport (Hesketh Park)	*Lancashire*	3·73	3·27	— ·46	88	·83	28	18
Wetherby (Ribston Hall)	*York, W.R.*	2·78	2·11	— ·67	76	·77	28	10
Hull (Pearson Park)	,, *E.R.*	3·05	2·50	— ·55	82	·75	28	15
Newcastle (Town Moor)	*North'land*	3·20	2·38	— ·82	74	·94	28	13
Borrowdale (Seathwaite)	*Cumberland*	11·47	6·95	—4·52	61	...	...	...
Cardiff (Ely)	*Glamorgan*	4·54	2·68	—1·86	59	·98	27	14
Haverfordwest	*Pembroke*	4·21	...	...	...	...	...	...
Aberystwyth (Gogerddan)	*Cardigan*	4·88	4·52	+ ·36	93	·90	25	14
Llandudno	*Carnarvon*	3·16	3·32	+ ·16	105	1·09	28	15
Cargen [Dumfries]	*Kirkcudbrt.*	4·23	3·45	— ·78	82	1·40	25	19
Marchmont House	*Berwick*	3·54	2·55	— ·99	72	·75	25	11
Girvan (Pinmore)	*Ayr*	4·54	3·21	—1·33	71	·60	26	24
Glasgow (Queen's Park)	*Renfrew*	3·62	2·49	—1·13	69	·70	25	15
Islay (Eallabus)	*Argyll*	4·49	4·61	+ ·12	103	·67	21	25
Mull (Quinish)	,,	5·00	6·21	+1·21	124	·87	25	27
Loch Dhu	*Perth*	6·70	3·20	—3·50	48	1·10	25	13
Dundee (Eastern Necropolis)	*Forfar*	3·34	2·44	— ·90	73	1·19	25	15
Braemar	*Aberdeen*	3·63	1·53	—2·10	42	·71	25	12
Aberdeen (Cranford)	,,	3·07	2·73	— ·34	89	1·32	25	16
Gordon Castle	*Moray*	3·29	2·25	—1·04	68	...	...	...
Drumnadrochit	*Inverness*	3.11	1·85	—1·26	59	·38	17	20
Fort William	,,	6·15	5·57	— ·58	91	·95	17	26
Loch Torridon (Bendamph)	*Ross*	6·61	9·10	+2·49	138	1·61	24	24
Dunrobin Castle	*Sutherland*	2·71	...	...	...	...	...	...
Glanmire (Lota Lodge)	*Cork*	3·83	3·27	— ·56	85	·94	18	13
Killarney (District Asylum)	*Kerry*	4·57	2·77	—1·80	61	·50	19	17
Waterford (Brook Lodge)	*Waterford*	3·73	4·41	+ ·68	118	1·34	18	13
Nenagh (Castle Lough)	*Tipperary*	4·04	3·10	— ·94	77	·56	31	21
Ennistymon House	*Clare*	5·01	3·34	—1·67	67	·81	31	17
Gorey (Courtown House)	*Wexford*	3·31	2·91	— ·40	88	·68	25	9
Abbey Leix (Blandsfort)	*Queen's Co.*	3·94	2·29	—1·65	58	·47	31	13
Dublin (Fitz William Square)	*Dublin*	3·08	2·29	— ·79	74	·43	25	16
Mullingar (Belvedere)	*Westmeath*	4·00	1·85	—2·15	46	·37	29	16
Crossmolina (Enniscoe)	*Mayo*	4·68	4·66	— ·02	100	·84	17	20
Cong (The Glebe)	,,	4·70	...	...	...	...	...	...
Collooney (Markree Obsy.)	*Sligo*	4·30	3·87	— ·43	90	·58	31	19
Seaforde	*Down*	3·64	2·98	— ·66	82	·96	25	14
Ballymena (Harryville)	*Antrim*	4·18	3·67	— ·51	88	·70	24	22
Omagh (Edenfel)	*Tyrone*	4·22	4·11	— ·11	97	1·05	24	18

SUPPLEMENTARY RAINFALL, AUGUST, 1919.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches
II.	Sevenoaks, Speldhurst Close.	2·65	XI.	Lligwy	3·03
,,	Ramsgate	1·52	,,	Douglas, Isle of Man	3·63
,,	Hailsham	3·72	XII.	Stoneykirk, Ardwell House...	2·87
,,	Totland Bay, Aston House...	2·95	,,	Carsphairn, Shiel	5·20
,,	Stockbridge, Ashley..	3·15	,,	Langholm, Drove Road	3·98
,,	Grayshott	3·34	XIII.	Selkirk, The Hangingshaw..	2·27
,,	Upton Nervet	2·74	,,	North Berwick Reservoir	2·54
III.	Harrow Weald, Hill House...	2·85	,,	Edinburgh, Royal Observaty.	...
,,	Pitsford, Sedgebrook	2·08	XIV.	Biggar	2·93
,,	Woburn, Milton Bryant	3·03	,,	Maybole, Knockdon Farm ...	3·74
,,	Chatteris, The Priory	1·91	XV.	Shiskine	3·29
IV.	Elsenham, Gaunts End	2·48	,,	Ardgour House	8·67
,,	Rayleigh	1·92	,,	Oban	...
,,	Colchester, Hill Ho., Lexden	2·26	,,	Holy Loch, Ardnadam	4·54
,,	Aylsham, Rippon Hall	2·13	,,	Loch Venachar	3·30
,,	Swaffham	2·58	XVI.	Glenquey	2·60
V.	Bishops Cannings	3·02	,,	Loch Rannoch, Dall	2·20
,,	Weymouth	2·56	,,	Blair Atholl	...
,,	Ashburton, Druid House	4·17	,,	Coupar Angus	2·19
,,	Cullompton	3·49	,,	Montrose, Sunnyside Asylum.	2·17
,,	Lynmouth, Rock House	2·57	XVII.	Balmoral	1·35
,,	Okehampton, Oaklands	...	,,	Fyvie Castle	2·34
,,	Hartland Abbey	2·69	,,	Keith Station	3·03
,,	St. Austell, Trevarna	3·55	XVIII.	Rothiemurchus	...
,,	North Cadbury Rectory	3·57	,,	Loch Quoich, Loan	14·70
VI.	Clifton, Stoke Bishop	2·86	,,	Skye, Dunvegan	6·62
,,	Ledbury, Underdown	2·11	,,	Fortrose	2·07
,,	Shifnal, Hatton Grange	2·17	,,	Glencarron Lodge	7·89
,,	Droitwich	2·02	XIX.	Tongue Manse	7·42
,,	Blockley, Upton Wold	2·78	,,	Melvich	4·47
VII.	Grantham, Saltersford	2·72	,,	Loch More, Achfary	15·83
,,	Louth, Westgate	3·23	XX.	Dunmanway, The Rectory ..	3·88
,,	Bawtry, Hesley Hall	2·50	,,	Mitchelstown Castle	2·34
,,	Derby, Midland Railway	2·09	,,	Gearahameen	5·40
VIII.	Nantwich, Dorfold Hall	2·78	,,	Darrynane Abbey	3·90
,,	Bolton, Queen's Park	...	,,	Clonmel, Bruce Villa	2·65
,,	Lancaster, Strathspey	3·83	,,	Roscrea, Timoney Park	2·17
IX.	Langsett Moor, Up. Midhope	...	,,	Broadford, Hurdlestown	2·82
,,	West Witton	2·76	XXI.	Enniscorthy, Ballyhyland...	3·25
,,	Scarborough, Scalby	2·83	,,	Rathnew, Clonmannon	2·65
,,	Ingleby Greenhow	3·33	,,	Hacketstown Rectory	3·16
,,	Mickleton	3·30	,,	Ballycumber, Moorock Lodge	2·24
X.	Bellingham, High Green Manor	3·07	,,	Balbriggan, Ardgillan	2·33
,,	Ilderton, Lilburn Cottage ...	2·03	,,	Castle Forbes Gardens	3·48
,,	Keswick, The Bank	4·27	XXII.	Ballynahinch Castle	5·61
,,	Orton	4·39	,,	Woodlawn	2·92
XI.	Llanfrechfa Grange	3·53	,,	Westport House	4·19
,,	Treherbert, Tyn-y-waun	5·67	,,	Dugort, Slievemore Hotel ...	...
,,	Carmarthen, The Friary	3·00	XXIII.	Enniskillen, Portora	...
,,	Fishguard, Goodwick Station.	2·46	,,	Dartrey [Cootehill]	2·58
,,	Crickhowell, Tal-y-maes	3·00	,,	Warrenpoint, Manor House ..	2·45
,,	Birmingham WW., Tyrmynydd	3·96	,,	Belfast, Cave Hill Road	3·96
,,	Lake Vyrnwy	2·72	,,	Glenarm Castle	2·74
,,	Llangynhafal, Plas Drâw	3·64	,,	Londonderry, Creggan Res...	3·79
,,	Rhiwbryfdir	7·77	,,	Milford Manse	3·47
,,	Dolgelly, Bryntirion	4·94	,,	Killybegs	5·17

Climatological Table for the British Empire, March, 1919.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	56·5	2	26·0	23	47·4	34·5	35·9	...	100·0	24·0	3·62	21	6·9
Malta	75·2	9	44·0	20	64·2	52·7	...	83	133·0	44·0	1·56	7	0·4
Lagos	96·0	21	71·4	27	88·7	78·5	77·2	80	157·4	63·0	5·98	7	7·9
Cape Town	99·7	14	52·8	27	82·2	61·1	58·1	66	...	...	·13	1	3·2
Johannesburg	83·8	29	48·5	14	75·3	55·9	52·3	73	...	47·7	3·44	7	4·2
Mauritius	88·5	11	65·2	29	84·7	73·3	71·2	78	...	62·8	7·98	15	6·3
Bloemfontein	91·4	4	48·9	21*	82·9	55·3	52·6	58	..	...	2·60	8	4·9
Calcutta...	102·9	31	60·6	5	94·7	70·0	63·4	58	...	52·3	·51	1	2·2
Madras	94·9	31	66·4	10	88·9	72·0	70·4	74	159·2	69·6	1·96	2	1·3
Colombo, Ceylon ...	93·5	29	68·6	3	89·8	73·5	71·8	77	158·6	62·0	3·36	10	3·2
Hongkong	82·8	25	53·8	31	70·9	63·9	63·9	90	...	...	1·76	11	9·1
Sydney	88·5	20	54·8	22	77·9	63·0	59·5	67	148·3	49·9	5·29	13	4·4
Melbourne	94·2	3	42·0	25	70·6	54·3	51·6	67	146·8	36·9	6·48	15	6·5
Adelaide	94·7	25	48·5	17	77·2	56·8	51·0	54	152·9	35·0	·09	4	4·0
Perth	103·2	9	52·1	27	83·6	63·9	57·0	59	164·2	43·0	·61	3	3·5
Coolgardie	104·8	17	52·8	26	88·9	61·8	51·0	40	165·8	48·5	·91	1	3·4
Brisbane	99·4	5	62·0	16+	85·1	67·8	63·9	67	155·0	57·8	6·02	14	4·6
Hobart, Tasmania ..	83·4	29	37·0	25	66·8	51·6	46·7	61	140·5	29·8	5·86	13	6·8
Wellington	73·8	8	41·9	23	66·8	54·0	50·2	69	138·0	25·6	1·10	6	3·8
Jamaica, Kingston ...	90·3	1	64·9	21	86·7	69·3	67·2	76	...	...	1·05	3	3·5
Grenada	88·0	17	70·0	20	85·0	73·0	...	68	138·0	...	·64	6	2·5
Toronto	56 0	26	7·3	6	42·1	25·5	23·7	74	109·0	4·2	3·19	11	4·7
Fredericton	57·0	26	−8·0	16	39·9	20·2	23·1	71	...	...	3·82	13	5·4
St. John, N.B. ...	54·3	26	4·0	14	39·6	25·7	25·7	72	119·5	3·9	3·21	15	5·9
Victoria, B.C.	62·5	29	32·0	1	50·0	32·0	38·0	80	125·0	23·0	2·22	18	6·9

* and 24. † and 20.

COLOMBO, CEYLON.—Mean temp. 81°·6, or 0°·3 above, dew point 0°·7 below, and R ·78 in. below, averages. Mean hourly velocity of wind 3·6 miles. TSS on 2 days. Prevailing direction of wind W.S.W.

HONGKONG.—Mean temp. 66°·7. Bright sunshine 80·5 hours. Mean hourly velocity of wind 13·5 miles.

Melbourne.—Mean temp. 2°·1 below, and R 4·28 in. below, averages; 3·55 in. of R fell on the 5th, the greatest fall for any one day in 64 years.

Adelaide.—Mean temp. 2°·9 below, and R ·96 in. below, averages; a cool month, only two having been cooler in the past 62 years.

Perth.—R ·12 in. below average.

Coolgardie.—Temp. 3°·9 above, and R ·18 in. above, averages.

Brisbane.—Temp. and R slightly above averages, the drought being finally broken.

Wellington.—Mean temp. 0°·2 above, and R 2·27 in. below, averages. Bright sunshine, 239·2 hours. One sunless day.

Symons's

Meteorological Magazine.

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"BRITISH RAINFALL, 1918."

"British Rainfall, 1918," the fifty-eighth annual volume of the series, by H. R. Mill and M. de Carle S. Salter, is now completely in type, and should shortly be ready for issue.

Although compiled entirely since the end of 1918 the new volume deals with the observations made during that year, and was prepared practically under the same conditions as its four predecessors which were published during the war. A severe restriction of space was therefore inevitable, but the size of the volume is slightly larger than that for 1917, and no break of continuity in the series of tables and maps has been necessary.

The Annual Report of the Directors to the Trustees, and a statement by Mr. Francis Druce, Treasurer to the Endowment Fund, give an account of the reasons which have led to the transfer of the responsibility for the future conduct of the British Rainfall Organization to the Government. The transfer was carried out on July 24th, 1919, and on the same date the resignation of Dr. H. R. Mill from the directorship, as stated in this Magazine for August, took place. Mr. Salter, who had acted as Assistant Director since 1913, and as Joint-Director with Dr. Mill since 1918, has been appointed Superintendent in charge of the work of the Organization. Dr. Mill contributes an article on the Development of the British Rainfall Organization since 1910, when it first ceased to be a purely private institution, bringing up to date his article in *British Rainfall, 1909*, which dealt with the first fifty years of its history. He outlines some of the possible future advances which it is hoped may be realized under the new conditions.

A full abstract of Mr. Salter's recent paper on the Relation of Rainfall to Configuration is also given, setting out some generalizations resulting from the cartographical treatment of rainfall data by Dr. Mill during the last nineteen years.

The statistical basis for the study of the rainfall of 1918 consisted of 4998 records, or 87 fewer than were available for 1917. The diminution in the number of stations has, however, been set off

by an improvement in distribution. The number of records of rainfall duration published continues to increase, and complete monthly tables of this element are given for 61 stations.

The year was characterized by an unusual absence of heavy daily rainfalls, but detailed accounts are given of several violent and extremely local thunderstorms during the summer.

The volume is fully illustrated, including a portrait of Dr. H. R. Mill, and the usual coloured map showing the relation of the year's rainfall to the average, this being the thirteenth map of the kind published in successive years.

WIRELESS METEOROLOGICAL INFORMATION TO AND FROM SHIPS AT SEA.

By Lieut. H. G. Grant, R.N.,
Superintendent, Meteorological Department of the Admiralty.

The *London Gazette* of 15th August last, contains over the signature of the Hydrographer of the Navy an Admiralty Notice to Mariners (No. 1393 of 1919) in regard to wireless meteorological information to and from ships at sea. There is no change whatever in the general arrangements for collection, transmission, and issue of information outlined in the previous Notice (No. 880 of 1919), published in *The Times* on May 6th (see this Magazine, May, 1919, p. 37), which is superseded by the present Notice. There are, however, several material changes in the schedule of wireless stations.

The note previously appearing in regard to the British stations at Poldhu and Cleethorpes to the effect that these stations "would be started shortly" is now deleted, and the stations are given as working. The station at Washington now issues bulletins at two fixed hours of the day instead of only one. New weather-reporting stations are notified as established at Annapolis, U.S.A., and for the Mediterranean at Rinella.

The Notice contains the information that negotiations are in hand to extend and unify the system of collecting weather data by wireless from ships at sea all over the world, and at the same time to organize the free transmission of weather bulletins from a sufficient number of wireless stations to admit of ships being constantly supplied with reliable weather reports and forecasts wherever they may be.

The Notice further adds :—"It should be borne in mind that the needs of ships at sea in regard to information regarding the weather will march hand in hand with the requirements of aircraft. The importance of this service will, therefore, be constantly increasing, and its success or failure will largely depend upon the co-operation of ships at sea in providing the data without which accurate fore-

casting is impossible. The matter does not depend solely upon the efforts of the ships selected to furnish the data. The essence of success lies in rapidity in passing such data by wireless from the ship to the coast station, and thence to the central meteorological office. It follows, therefore, that all ships not taking an active part in supplying data should use the greatest care not to interfere with the transmission of the wireless messages to the shore.

"Earnest endeavours are being made to obtain international agreement as to the form of these weather bulletins and to the methods and times of transmission. It is hoped that the messages will eventually all be made in an international code at fixed times, so arranged that a ship with only one wireless operator will be able to read them. A similar scheme for time signals is being evolved."

The Naval Meteorological Service under the Hydrographic Department of the Admiralty issue the following Wireless Weather Bulletins, giving in plain language forecasts for specified areas for the information of ships at sea, namely :—

1. *Western and South-Western Seaboard of the British Isles :—* Embracing the Western and South-Western Seaboard of the British Isles, and including the Bristol Channel and Mouth of the English Channel ; also, when possible, the Bay of Biscay.

This Weather Bulletin is identified by the prefix, "Western."

(*a.*) Wireless Telegraph Weather Bulletin, giving forecast for the following 12 hours, issued to "All Ships" from Poldhu, at 0930 G.M.T. (9.30 a.m.), on 2,700 metres wave, based on observations taken at 0700 G.M.T. (7 a.m.).

(*b.*) Wireless Telegraph Weather Bulletin, giving forecast for the following 12 hours, issued to "All Ships" from Poldhu, at 2130 G.M.T. (9.30 p..m) on 2,700 metres wave, based on observations taken at 1800 G.M.T. (6 p.m.)

2. *North Sea, Eastern and South-Eastern Seaboard of British Isles :*—Embracing entire North Sea and also English Channel.

This Weather Bulletin is identified by the prefix "Eastern."

(*a.*) Wireless Telegraph Weather Bulletin, giving forecast for the following 12 hours, issued to "All Ships," from Cleethorpes, at 0500 G.M.T. (5 a.m.) on 3000 metres wave, based on observations taken at 0100 G.M.T. (1 a.m.).

(*b.*) Wireless Telegraph Weather Bulletin, giving forecast for the following 12 hours, issued to "All Ships," from Cleethorpes, at 1700 G.M.T. (5 p.m.) on 3,000 metres wave, based on observations taken at 1300 G.M.T. (1 p.m.).

By arrangement with the Admiralty these Bulletins are also published daily in the weather columns of *The Times.*

It is interesting to observe that somewhat similar messages which give both data for selected stations and forecasts in non-technical language for specified areas are prepared by the Weather Bureau of the United States and circulated from Arlington.

BRITISH ASSOCIATION AT BOURNEMOUTH.

At the Conference of Delegates of Scientific Societies, Lord Montague of Beaulieu, President, in the chair, Mr. M. de Carle S. Salter, Superintendent of the British Rainfall Organization, read a paper entitled, "The Exposure of Rain Gauges, "of which the following is a brief abstract :—

As the result of several series of experiments conducted under the direction of the late Mr. G. J. Symons the adoption of the Standard rain gauge, exposed at one foot above ground, has become general in this country. The diminution of catch in rain gauges exposed at greater heights above ground was long thought to be due to a variation in the fall at different elevations, but is now recognized as being caused by wind eddies preventing the rain from entering the funnel. Gauges sufficiently sheltered yield substantially indentical results at all elevations above ground. Far too little attention has been given to the provision of proper shelter from strong wind in placing rain gauges. In inland and naturally sheltered localities this precaution may usually be neglected with impunity, but in positions near the sea or at considerable altitudes, shelter, especially on the side of the prevailing wind, is necessary. In such positions the loss caused by elevating the gauge more than one foot above the ground is greater proportionally to the degree of exposure. It is greatly aggravated in the case of snow and still more so should the gauge be of the obsolete shallow-funnel type. Rain gauges should on no account be placed on sites where the land slopes downwards on the side of the prevailing wind, or near the top of a cliff or terrace. As a general rule the loss of catch in faultily exposed gauges occurs principally in the winter months, and, save in exceptional cases the loss in the summer half year may be safely ignored.

Whilst avoiding over exposure it is equally important to place a rain gauge so that no part of the rain shall be intercepted by objects too near the gauge, more particularly by trees or growing plants.

The existence of errors in rainfall records due to faulty exposure, is usually made apparent by the want of harmony with values at neighbouring stations observed when plotting rainfall maps. A large number of instances of want of harmony have been specially investigated, the gauges in nearly every case proving to be defective, either in construction or exposure. The degree of disparity which may be taken to indicate error decreases largely with the length of period dealt with, inconsistencies of 25 per cent. in a month's rainfall, not explained by the configuration, being sometimes due to variations in the actual fall, whilst in mapping the rainfall of a year, or the average of a series of years, a variation of 5 per cent. would probably indicate error.

On Thursday, September 11th, at Linden Hall, Bournemouth, a meteorological luncheon was held, Sir Napier Shaw in the chair. We hope to give an account of this in our next issue.

FLOOD WARNINGS IN NEW ZEALAND.

THE problem of flood prevention in New Zealand is dealt with in a recent report by the Dominion Meteorologist, Lt.-Col. D. C. Bates, to whom we are indebted for the following notes. The interference of civilization with natural conditions is not usually in the direction of lessening flood damage, clearing and drainage, causing the water to run off quickly, thus increasing the scouring of slopes and deposition of silt in the lower reaches. The effect is to raise the general level of the lower beds and aggravate flooding. The problem of prevention is one which appears only to be soluble as a national task, the reconciliation of conflicting interests being too difficult to achieve on any other lines and the report recommends strongly the organization of both prevention and warnings on a proper basis.

Attention is directed to the abnormal flooding which not infrequently occurs when the winter snows melt, these being entirely disproportionate to the actual amount of precipitation. Apart from snow the run-off is stated to be approximately 25 per cent. of the precipitation, a figure which we imagine must be applied only with a very generous margin of uncertainty. Experience in the British Isles shows us that the expression of the run-off as a percentage of the amount of precipitation is misleading, since quite apart from the very great variability at different seasons and under different conditions of soil and weather, recognized by Mr. Bates, it is practically certain that a much larger proportion of run-off occurs when the average rainfall is large than when it is small.

The prediction of floods may be attempted on (i.) the weather chart; (ii.) the records of rainfall in the river basins, and (iii.) the actual rise of the streams in their upper reaches. Owing to the known uncertainty, especially in respect to locality, in forecasting heavy rain, the first mentioned method is only applicable in a general manner. The second source of information is undoubtedly capable of development by provision of more observing stations and improving means of communicating records, but the actual rising of the river affords the most certain and striking means of forecast, not only for the time but for the height of an inundation.

The report recommends the closer observation of rainfall, the establishment of flood gauges, and the formation of a Committee of Safety or Rivers Board charged with the organization and administration of flood warnings in consultation with the Dominion Meteorological Service, the Public Works and Railway Departments.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

EARLY SNOW.

On the morning of September 20th, we had a fall of snow, almost a covering. The earliest I have hitherto recorded snow at Sunderland, since 1857, inclusive, was October 4th, which was in 1867. Since the 20th there have been some warm days, the thermometer reaching 67° on the 25th. T. W BACKHOUSE.

West Hendon House, Sunderland, September 27th, 1919.

On looking out at 8 a.m. (Summer Time), September 20th, I could scarcely believe my eyes on seeing the Black Mountains glistening with snow under a brilliant sun. On the previous day I had expected to hear of the first snow on the Scottish mountains with the cold north-westerly type of weather then prevalent, but I was not prepared to see snow actually lying in Herefordshire. The snow-level was about 1,300 feet; it had all gone by 11 a.m. (though probably not on the northern slopes, invisible from here). The Clee Hills round Ludlow, had a covering of two to three inches, and the Ludlow hounds meeting at the foot of the hills had to be stopped in a run and taken off to the lower ground owing to the snow balling in the horses' feet; the snow lasted here till about mid-day. In the early morning there was a slight trace lying right down in the Teme Valley, not 300 feet above sea-level. We had a September snow last year, on the 29th, which I never expected to see equalled, much less eclipsed by nine days, and that within a year. On that occasion the cold was caused by the passage of a depression to our south and Sunday, September 29th, 1918, had a maximum temperature of only 45°, with a bitter rain from east and north-east. After 3 p.m. (G.M.T.) temperature was 40° or below, and above 800 feet snow was mingled with the rain. The Black Mountains were covered quite six inches deep, and remained pure white for twenty-four hours above 2,300 feet, while drifts remained for a week. There was no further snow lying on them till within a week of Christmas! September, 1919, closed with severe frost, the exposed thermometer 4 feet above ground on the morning of the 29th, registering a minimum of 21°, the lowest September reading recorded in 33 years' observations. Walnuts were frozen on the trees and completely destroyed, being subsequently turned into a dry, black, crinkled pulp.

Kentchurch Rectory, Hereford, September 30th, 1919. R. P. DANSEY.

A RECORD RAINFALL FOR GUERNSEY, 1894-1919.

THE depression of September 2nd and 3rd gave the biggest rainfall at this station in the twenty-six years, 1894-1919.

Rain set in with a south wind at 2 p.m., on September 2nd, and after falling spasmodically during the afternoon and evening (·67 in. fell in the first three hours) the wind veered to north, and a steady downpour followed. At 9 a.m. on the 3rd, the total for the seventeen hours was just 2·50 in.; or ·08 in. in excess of my previous heaviest daily fall, viz., 2·42 in., on October 2nd, 1904.

In the twenty-six years 2 inches of rain as a daily fall has been recorded four times only at this Channel Island station.

As regards this week's rainfall, the heaviest rain fell undoubtedly with the north wind and ceased gradually and ultimately altogether with a backing of the wind to north-west and west.

"*Les Blanches,*" *Guernsey, September 5th, 1919.* BASIL T. ROWSWELL.

THE CLIMATE OF MESOPOTAMIA.

THE following extracts from letters from a friend in Mesopotamia may be of interest to readers of this Magazine.

From Corpl. R. J. Smith, R.E., April 6th, 1918 :—

> "... I will now give you a little idea of the meteorological conditions out here. There is an enormous difference between summer and winter temperatures. We have been experiencing a very cold and wet winter, after having had no rain for nearly nine months. The hot weather is late in starting this year, but it will not be many days now before we need topees and spine-pads. Our coldest day this winter was in last December, when 14° of frost were registered, and the hottest last summer was 124°·8 in shade. In tents it goes up to at least 135°. The buttons on one's tunic get too hot to touch the same with one's rifle and all metal objects. The glare is terrible, and one needs dark blue glasses; further protection from the sun is given by spine-pads, and helmet shades (a flap which comes over the nape of the neck) ... In the winter we feel the cold tremendously, especially as we have to live in tents (more or less rain-proof), and have no fires, not even a charcoal brazier. This [Mesopotamia] is a healthy climate in the winter, better than India, I think ...."

From Corpl. R. J. Smith, R.E., July 31st, 1918 :—

> "The highest shade temperature ever officially recorded in Baghdad is 124°·8 F., in July, 1917, and the coldest, 18°·6 F., a few years ago. Last winter, at Baqubah, we often had 12° of frost. As regards rainfall (in Mesopotamia) none has ever been known during the months June to September, and the total per year is 6·89 in., which falls on an average of sixteen rain-days. In the winter the rain is like what one experiences in England, accompanied by very high winds and dust storms, when the rain ceases, which is very uncomfortable during camp life, as the dust penetrates everywhere. The mean daily maximum shade temperature for this month (July), is 109°·2, and minimum ditto 79°·7 .... August is the worst month, so have plenty of hot weather to come. I am writing this in a temperature of 112° F.

Tower Park, Moretonhampstead. D. W. HORNER, F.R.Met.Soc.

DEATH BY LIGHTNING—AN UNUSUAL PHENOMENON.

On Sunday, the 14th September, 1919, about 7.40 p.m., I was called to see a man who was struck down by lightning at Finsbury Park, London, N. He was accompanied by his wife and his wife's sister. At the inquest his wife stated that with a particularly vivid flash she was thrown down and rendered unconscious for a short time. When she recovered she found her husband standing erect with his coat on fire, and she tried to extinguish the flames. With the next peal of thunder he expired. A man who was running to his assistance told me he saw the man falling backwards against the iron fencing near. There were rows of elm trees at the spot where he was at the time.

The coat was severely burnt from the collar down to the bottom, nearly completely severing the coat in two. The back of the waistcoat was likewise badly burnt, and his shirt less so. The edges of the braces were burnt at one place on each; trousers at upper part of back slightly. The hair of the back of the head was singed. There was a burn on the back of the neck. The space between the middle of both scapulæ was extensively burnt to the first degree, the mid-dorsal region slightly, but on both sides severely. At the right lower lumbar region was the largest burn. At various spots there were slight points of burns (punctures). Generally speaking the burns on the *right* side of the back were all worse than those on the left. He was evidently struck from the right side of his back.

From the right shoulder and across the chest and down to the lower of the front of the abdomen impressions of branches and leaves were clearly imprinted on the skin, showing like an X-ray plate how certain rays of light were impeded by the branches and foliage, whilst others made the contour of these. There were two distinct branches with leaves, one occupying the space between the right iliac crest to near the ensiform cartilage and the other proceeding down on the left side from the stomach to the left iliac crest. To my mind it would appear as if these were implanted while the man was falling back with a flash coming over the right shoulder.

A. G. NEWELL, M.D., D.P.H.

Harringay, N. 8, September 21st, 1919.

[The production of a pattern resembling foliage is very curious, and at first sight, considering the great length of the source of light, it seems impossible to suppose the pattern to have been formed as a shadow. It may be, however, that the particular flash was approaching the tree in such a way that the man would have seen it end-on, and in that position sharp shadows would have been formed.—Ed., *S.M.M.*]

WIND IN RELATION TO TIDE.

It would be interesting to know the opinions and experiences of your readers as regards the change in direction or force of the wind in relation to the change of tide. It is common to find that among fishermen the belief is held that the tide has a distinct influence on the wind, and although the theory is usually discredited among meteorologists, it is certainly upheld to a great extent by my own modest experiences on this coast. Of course, there are many occasions when there is nothing in common between wind and tide, and perhaps the other occasions are mere coincidences, although they seem to occur too often to be classed as such. The change of the time of the turn of the tide from day to day naturally increases the possibility of a change in the force or direction of the wind coinciding with it. In the Bristol Channel, the tides of course run with great strength, and it is necessary to be on the sea to observe the influence on the wind. I am frequently out fishing at all times of the year and in conversation with the local fishermen, so have had fair opportunities of studying the subject.

The general direction of this coast runs E. to W., and so faces at right-angles to the flow of tide in the Channel, and there is a tendency for winds to group themselves round E. and W. With easterly winds, if there is some strength in them, there is a tendency to freshen as soon as the ebb-tide sets down, and to become lighter when the flood makes up, or as they say here, "the flood runs the wind off." When there are only light easterly winds they usually die away in the afternoon, "the sun eats the wind up," to quote a local saying again, or back N.W. at the change of tide, either ebb or flood. A very common wind here is W.N.W. to N.W. during the summer, in fact, it is on an average the most prevalent wind during that season. It gradually freshens to a fresh or strong breeze, until late afternoon, when it begins to fall off, and is known locally as a "sun-breeze," and is, in fact, a typical sea-breeze. The tide does not seem to make much difference in its strength, except that it usually freshens somewhat on the ebb. Another rather similar wind frequently occurs, when the true wind is S.W. and light in force, but on these occasions it is more northerly, and causes fog to form on the headlands. This wind nearly always seems to coincide with a change of tide, whether ebb or flood seems immaterial. All the above may be taken as occurring in "fine" weather, but when depressions are passing the effect of the tide is, as a rule, not so marked, of course, as there is a more general flow of air. However, I have frequently experienced sudden shifts of wind from S.W. to N.W. during bad weather, when the tide begins to flow. These squalls are sometimes very fierce, but usually fall off in strength after some time.

These are a few cases where very often there really does seem to be relationship between the tide and wind. It is, however, a complex subject, and doubtless varies on different parts of the coast.

Minehead, Somerset, September 15th, 1919. T. F. TWIST.

METEOROLOGICAL NEWS AND NOTES.

METEOROLOGICAL OFFICE APPOINTMENTS. The following appointments on the staff of the Meteorological Office have been notified. MR. R. G. K. LEMPFERT, M.A., C.B.E., late Superintendent of the Forecast Division, to be Assistant Director for general oversight of Observatories and Stations contributing observations to the Office as from September 1st, 1919. LT.-COL. E. GOLD, D.S.O., F.R.S., lately in command of the Overseas Contingent of the Meteorological Section of the Royal Engineers, to be Assistant Director in charge of Forecasting, as from September 1st, 1919. CAPT. D. BRUNT, M.A., to be Superintendent of Meteorological work for Army Services.

SIR RICHARD GLAZEBROOK, C.B., F.R.S., retired from the directorship of the National Physical Laboratory on September 18th, after twenty years' service, during which time the work and scope of the laboratory have been developed in an extraordinary manner. Professor J. E. Petavel, D.Sc., F.R.S., of Manchester University has been appointed as the new Director.

MEETINGS AT THE METEOROLOGICAL OFFICE for the discussion of contributions to current meteorology in Colonial and Foreign Journals will be resumed in November. The days arranged are Mondays, November 3rd and 17th, December 1st and 15th, 1919, and January 5th and 19th, February 2nd and 16th and March 1st, 15th and 22nd, 1920. The Director will be glad if Observers and others interested in Meteorology will favour him with their presence and take part in the discussions.

THE BRITISH DOMINIONS Meteorological delegates in the course of the recent Conference in London visited the headquarters of the British Rainfall Organization at 62, Camden Square, on September 26th. An exhibit of rainfall maps showing all branches of cartographical research on the distribution of rainfall was arranged.

FROSTS occurred on five days in September at Bristol where the shade temperature range for the month was 56°·3. At Camden Square the shade minimum on the 29th was 32°·2 being 0°·8 lower than the previous lowest temperature in September during 62 years.

SOUTH TEXAS experienced a tropical storm of unusual violence on September 14th. A Reuter New York message gives the fatalities in Corpus Christi and neighbouring localities at 120 and estimates the damage to property at about £2,000,000, while the Central News Washington correspondent says that approximately 30,000 people are homeless.

NOTES ON THE CLIMATE OF MESOPOTAMIA.

By C. H. E. Ridpath.

(*Continued from page* 91.)

During the summer dust-devils may be seen every day. Their diameter at the base is anything up to fifty yards. They travel with the wind and possess plenty of energy and lifting power. They extend many hundred feet into the air. A pilot in our squadron happened once to fly over the top of a dust devil. He was not lifted but fell 1,000 feet so quickly that the machine barely stood the strain when it suddenly encountered denser air again.

Dust storms, of course, take place on a much larger scale. It is noticeable sometimes how a cool wind will suddenly replace a hot wind in the opposite direction. During such a storm the dust particles will charge up wireless aerials to such an extent that the aerial, which, of course, is insulated from earth, will at times yield a spark, over a half-inch gap to earth, of a high enough frequency to cause a musical note. Such storms stop all wireless communication, but in any case atmospherics are bad the whole summer.

During the hot days if one is not lucky enough to have ice, porous pots or "chatties" give cool water. I often found 20° difference between air temperature and that of water in these vessels. They are a happy hunting ground, however, for mosquito larvæ. Water left out all day in non-porous vessels becomes scalding.

The adaptability of the human system is wonderfully exemplified when one considers that it can retain a temperature not far from the normal 98°·6 in an atmosphere of 120° and over. If perspiration stops there is immediate danger of heat stroke. It must be remembered that although a Stevenson screen may only register, say 120°, temperatures in tents may reach 125° and 130°; I have heard of higher figures, but doubt their accuracy.

In winter the prevailing winds are north-west and also points between south-east and south-west. The former wind brings fine weather, sometimes with very cold nights, but the latter brings thunderstorms and wet weather. Atmospherics are almost totally absent with the former wind, but reappear directly a change to the south takes place. I can best describe the winter by saying one provides oneself with clothing similar to that for an English winter. In December, 1917, a minimum of 16° was recorded at Samarra on the Tigris, eighty miles north of Baghdad. It is really an excellent climate in winter.

Rain is made to appear worse than it is owing to the fact that the soil is entirely composed of alluvial mud, one does not see much sand. This mud is, of course, baked hard in summer, except where there is traffic, when it turns into several inches of very fine light dust providing a good nucleus for dust devils and other abominations. A few hours' rain creates mud of a very tenacious quality sufficient to stop all motor traffic. Operations in winter were some-

times seriously handicapped by the weather, for at times communications from railhead were 150 miles long.

Thunderstorms of a fairly violent character take place the whole winter, but present no unusual features. On the average, winds do not attain abnormal force. In judging the elements when one is under canvas, great care has to be taken not to over-estimate. When a tent that contains all one's worldly possessions, is making a noise like stage thunder and exuding water at every pore at 2 a.m. with every sign of imminent collapse, one may be forgiven a little exaggeration !

I was once afforded an excellent example of the relation between atmospheric electricity and rainfall. I happened to be experimenting in a receiving station at the base of an eighty foot wireless mast near Hit, on the Euphrates. Quite suddenly, through the telephones, I heard the aerial start to charge up at a very rapid rate accompanied by the usual hissing sounds of brush discharges ; in a few seconds very heavy rain indeed started. The storm lasted three or four minutes, but was so intense that one could only see a few yards away. I would not like to estimate the rain that fell in those four minutes, but I do know that destructive torrents appeared like magic and rushed through the camps doing a lot of damage. This storm did not start gradually but at once. Would it not be possible that the charging up of the aerial was due to a large volume of air being driven down under the first rush of the rain? Coming from a height this air would be at a higher potential than that of earth. This rain was unaccompanied by thunder, lightning or wind. At other times I have noticed similar but less intense phenomena. As soon as the rain starts the charging up of the aerial ceases, the aerial insulation from earth is of course, unimpaired by rain.

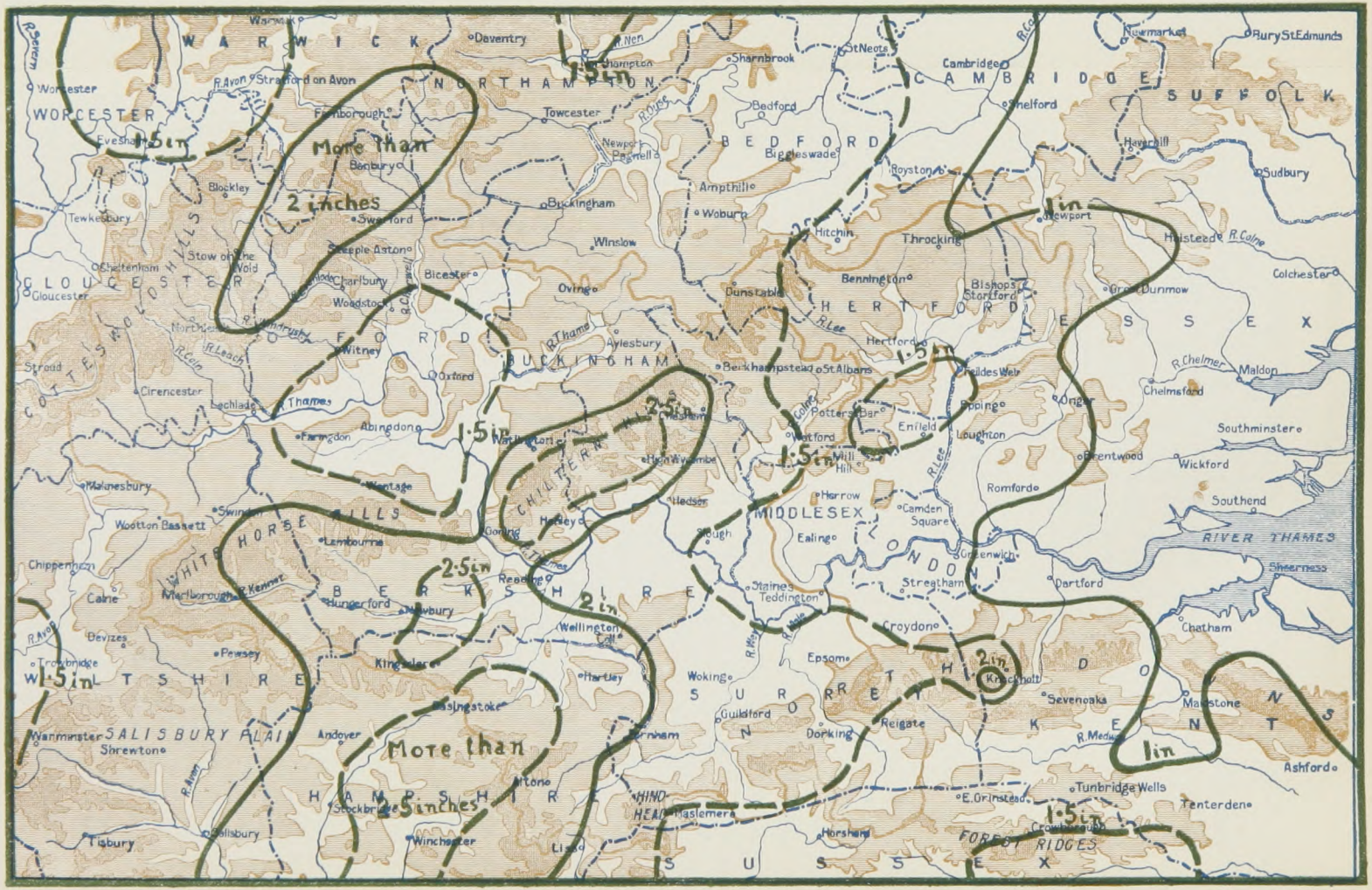
In spite of several storms and the fact that our eighty foot iron masts were the tallest of neighbouring objects, we never had one struck. This fact confirms the view that the function of a lightning conductor is to "tap off" high potential atmosphere at an altitude and relieve a tension that otherwise might bring about an actual discharge.

The Turks have had this country of wonderful possibilities for close on five hundred years and have done everything retrogressive : yet the land cries out for cultivation. After the first rains of autumn, barren desert yields grass, which in places becomes luxuriant by the next spring, only to wither and disappear once more with the return of the heat. Remains of great canals built by the ancients can still be seen and speculation is interesting on the amount of cultivation and its effect on the climate in those far-off days.

Mesopotamia was once a land of greatness and abundance ; under Turkey the land was barren ; under a wise and enterprising administration there are, indeed, great possibilities.

Erratum.—In the first part of this article the date 1918 should read 1917. and 1919 should read 1918.—C. H. E. Ridpath.

THAMES VALLEY RAINFALL SEPTEMBER 1919



Symons's Meteorological Magazine

Watershed of River Thames above Teddington, and River Lee above Feildes Weir

Isohyetals.

WEATHER OF SEPTEMBER.

THE month was distinguished by great fluctuations in temperature, some daily readings being unusually high for the time of year, and others equally low.

During the opening days the weather was influenced by a cyclonic system, which skirted our Atlantic seaboard, the winds being mainly from S. or S.W., with mild changeable conditions, and heavy rain on the 1st, in many western and northern districts. As the disturbance passed away the wind drew into W., and over a large portion of England the type of weather became anticyclonic. With an abundance of bright sunshine the thermometer rose steadily to a high level, the maximum shade readings on the 11th being above 85° at many English stations. At Raunds (Northants) the thermometer reached 90°, and in most parts of the country the day was hotter than any in the three summer months, June to August. On the 12th, when a new anticyclone spread in from the Atlantic, the wind shifted to N. and N.E., and a rapid fall of temperature occurred. In many places the change in twenty-four hours amounted to at least 20°, and at Nottingham to 28°, the shade maxima on the 11th and 12th being respectively 85° and 57°. Sharp frost occurred in Scotland on the nights of the 13th and 14th, the sheltered thermometer falling to a minimum of 27° at Balmoral and West Linton.

With the continued extension of the Atlantic high-pressure system, the polar current gradually died away, and on the 17th and 18th, the thermometer exceeded 70° in many of the English districts. A well marked depression (secondary to a larger disturbance over Scandinavia) skirted the north of Scotland on the 18th, and in its rear a fresh N. wind sprang up over the whole of the United Kingdom. Another rapid fall of temperature consequently took place, the maximum readings on the 19th and 20th being below 55° in most places, and below 50° at many northern stations. Sharp ground frosts occurred on the night of the 19th, the exposed thermometer sinking to 17° at Rounton (N. Yorks) and to 22° at Crathes, Durham, Worksop and Wisley. Snow fell about this time over a large portion of North Britain, and sleet or hail in many southern districts. During a spell of westerly winds, which prevailed between the 24th and 27th, the air again became much milder, and on the 25th most places experienced a shade maximum temperature well above 65°. A subsequent veering of the wind to the N.W. brought about a fresh reduction in temperature, and on the three nights, 27th to 29th, sharp frost was general. On the surface of the grass the minimum readings about this time were as low as 15° at Rhayader, 17° at West Linton, and 19° at Greenwich and Richmond.

Thunderstorms occurred locally over the southern half of England on the 6th and again on the 13th or 14th, and in the north of England and the south of Scotland on the 11th or 12th. Bright sunshine was fairly abundant.

The rainfall of the month was light over the southern and central areas of Great Britain, but increased towards the north, and in the Western Highlands was in excess of the average. It varied little from the average over Ireland. Less than an inch fell over the Thames Estuary, parts of East Anglia and the south-east coast, and less than 2 inches along nearly the whole of the east coast and in scattered areas in the south and Midlands. In the Pennines, the Welsh mountains, and over the greater part of the west of Scotland, the fall reached 5 inches. It exceeded 10 inches in Merionethshire, the English Lake District and over a considerable part of Inverness-shire. Between 2 and 4 inches fell over nearly the whole of Ireland, but more than 6 inches was recorded in elevated areas in the west and north. Nearly 10 inches fell in the mountains of Connemara. The general rainfall expressed as a percentage of the average, was :—England and Wales, 78; Scotland, 112; Ireland, 97; British Isles, 94.

In London (Camden Square) fine, warm weather prevailed in the early part. Shade temperature exceeded 70° on each of the first 13 days, and exceeded 80° on 4 days. A period of showery and cool weather followed, and on the 29th the shade minimum fell to 32°·2. Duration of rain, 14·4 hours. Evaporation, 1·53 inches.

RAINFALL TABLE FOR SEPTEMBER, 1919.

STATION.	COUNTY.	RAINFALL.						
		Aver. 1875–1909. in.	1919. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days
Camden Square	*London*	2·00	1·29	— ·71	64	·51	14	10
Tenterden	*Kent*	2·25	1·35	— ·90	60	·53	22	8
Arundel (Patching)	*Sussex*	2·58	1·55	—1·03	60	·68	22	7
Fordingbridge (Oaklands)	*Hampshire*	2·39	1·61	— ·78	67	·80	2	12
Oxford (Magdalen College)	*Oxfordshire*	1·98	1·23	— ·75	62	·35	2	12
Wellingborough	*Northampn*	2·13	1·44	— ·69	68	·66	6	9
Bury St. Edmunds (Westley)	*Suffolk*	2·18	·59	—1·59	27	·20	22	9
Geldeston [Beccles]	*Norfolk*	2·13	·54	—1·59	25	·16	19	6
Polapit Tamar [Launceston]	*Devon*	3·11	1·82	—1·29	59	·39	19	13
Rousdon [Lyme Regis]	,,	2·69	1·54	—1·15	57	·42	4	11
Ross (Birchlea)	*Herefordshr.*	2·39	1·42	— ·97	59	·37	2	15
Church Stretton	*Shropshire*	2·40	2·40	·00	100	·89	12	9
Boston	*Lincoln*	2·07	1·52	— ·55	73	·96	5	10
Worksop (Hodsock Priory)	*Nottingham*	1·84	1·86	+ ·02	101	·69	13	14
Mickleover Manor	*Derbyshire*	2·11	1·78	— ·33	84	·58	22	13
Congleton (Buglawton Vic.)	*Cheshire*	2·67	2·68	+ ·01	100	·64	22	18
Southport (Hesketh Park)	*Lancashire*	3·09	2·35	— ·74	76	·64	1	17
Wetherby (Ribston Hall)	*York, W.R.*	2·11	1·02	—1·09	48	·30	1	6
Hull (Pearson Park)	,, *E.R.*	2·05	1·40	— ·65	68	·47	13	13
Newcastle (Town Moor)	*North'land*	2·00	1·05	— ·95	52	·33	1	11
Borrowdale (Seathwaite)	*Cumberland*	11·28	14·65	+3·37	130	...	...	...
Cardiff (Ely)	*Glamorgan*	3·61	2·64	— ·97	73	1·20	22	17
Haverfordwest	*Pembroke*	3·91	2·38	—1·53	61	·48	22	17
Aberystwyth (Gogerddan)	*Cardigan*	3·89	3·63	— ·26	91	1·06	22	16
Llandudno	*Carnarvon*	2·50	1·91	— ·59	76	·56	22	17
Cargen [Dumfries]	*Kirkcudbrt.*	3·34	3·60	+ ·26	108	·75	29	19
Marchmont House	*Berwick*	2·67	1·53	—1·14	57	·41	12	14
Girvan (Pinmore)	*Ayr*	4·30	4·61	+ ·31	107	·78	12	18
Glasgow (Queen's Park)	*Renfrew*	2·99	2·42	— ·57	81	·46	4	18
Islay (Eallabus)	*Argyll*	4·49	5·00	+ ·51	111	·84	25	25
Mull (Quinish)	,,	5·20	7·50	+2·30	144	·91	21	25
Loch Dhu	*Perth*	6·22	6·90	+ ·68	111	1·10	25	19
Dundee (Eastern Necropolis)	*Forfar*	2·34	1·18	—1·16	77	·31	1	15
Braemar	*Aberdeen*	2·73	2·73	·00	100	·57	19	17
Aberdeen (Cranford)	,,	2·69	2·61	— ·08	97	·66	19	14
Gordon Castle	*Moray*	2·58	3·27	+ ·69	127	...	...	...
Drumnadrochit	*Inverness*	2·94	2·58	— ·36	88	·93	22	21
Fort William	,,	6·66	7·90	+1·24	119	1·60	25	25
Loch Torridon (Bendamph)	*Ross*	7·28	11·20	+3·92	154	2·22	25	23
Dunrobin Castle	*Sutherland*	2·51	2·85	+ ·34	114	·53	22	16
Glanmire (Lota Lodge)	*Cork*	3·20	2·01	—1·19	63	·40	30	14
Killarney (District Asylum)	*Kerry*	3·79	3·13	— ·66	83	1·19	30	19
Waterford (Brook Lodge)	*Waterford*	3·19	2·14	—1·05	67	·70	30	10
Nenagh (Castle Lough)	*Tipperary*	3·16	3·27	+ ·11	104	·88	22	19
Ennistymon House	*Clare*	4·22	5·75	+1·53	136	1·05	22	20
Gorey (Courtown House)	*Wexford*	2·78	2·68	— ·10	96	·76	3	14
Abbey Leix (Blandsfort)	*Queen's Co.*	2·93	2·22	— ·71	76	·82	22	14
Dublin (Fitz William Square)	*Dublin*	2·06	2·00	— ·06	97	·47	22	16
Mullingar (Belvedere)	*Westmeath*	3·02	...	...	...	...	...	...
Crossmolina (Enniscoe)	*Mayo*	4·42	4·45	+ ·03	101	·84	3	21
Cong (The Glebe)	,,	4·05	...	...	...	...	...	...
Collooney (Markree Obsy.)	*Sligo*	3·65	3·95	+ ·30	108	·62	3	21
Seaforde	*Down*	3·25	2·92	— ·33	90	1·16	4	19
Ballymena (Harryville)	*Antrim*	3·43	3·44	+ ·01	100	·35	30	19
Omagh (Edenfel)	*Tyrone*	3·39	4·19	+ ·80	124	·45	30	23

SUPPLEMENTARY RAINFALL, SEPTEMBER, 1919.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches
II.	Sevenoaks, Speldhurst Close.	1·37	XI.	Lligwy	3·72
,,	Ramsgate	·90	,,	Douglas, Isle of Man	...
,,	Hailsham	1·16	XII.	Stoneykirk, Ardwell House...	2·84
,,	Totland Bay, Aston House...	1·44	,,	Carsphairn, Shiel	5·70
,,	Stockbridge, Ashley..	2·45	,,	Langholm, Drove Road	6·11
,,	Grayshott	1·62	XIII.	Selkirk, The Hangingshaw..	1·97
,,	Upton Nervet	3·24	,,	North Berwick Reservoir	2·57
III.	Harrow Weald, Hill House...	1·36	,,	Edinburgh, Royal Observaty.	2·23
,,	Pitsford, Sedgebrook	1·41	XIV.	Biggar	3·31
,,	Woburn, Milton Bryant	2·19	,,	Maybole, Knockdon Farm ...	4·42
,,	Chatteris, The Priory	1·72	XV.	Shiskine	3·77
IV.	Elsenham, Gaunts End	1·09	,,	Ardgour House	12·55
,,	Rayleigh	·55	,,	Oban	5·57
,,	Colchester, Hill Ho., Lexden	·71	,,	Holy Loch, Ardnadam	6·44
,,	Aylsham, Rippon Hall	·95	,,	Loch Venachar	4·60
,,	Swaffham	1·00	XVI.	Glenquey	6·50
V.	Bishops Cannings	1·83	,,	Loch Rannoch, Dall	3·10
,,	Weymouth	1·31	,,	Blair Atholl	...
,,	Ashburton, Druid House	3·07	,,	Coupar Angus	·96
,,	Cullompton	...	,,	Montrose, Sunnyside Asylum.	1·27
,,	Lynmouth, Rock House	2·08	XVII.	Balmoral	3·50
,,	Okehampton, Oaklands	...	,,	Fyvie Castle	5·57
,,	Hartland Abbey	1·57	,,	Keith Station	4·40
,,	St. Austell, Trevarna	2·84	XVIII.	Rothiemurchus	...
,,	North Cadbury Rectory	1·62	,,	Loch Quoich, Loan	...
VI.	Clifton, Stoke Bishop	1·61	,,	Skye, Dunvegan	8·59
,,	Ledbury, Underdown	1·30	,,	Fortrose	2·40
,,	Shifnal, Hatton Grange	1·72	,,	Glencarron Lodge	9·53
,,	Droitwich	1·60	XIX.	Tongue Manse	4·77
,,	Blockley, Upton Wold	1·80	,,	Melvich	2·67
VII.	Grantham, Saltersford	1·78	,,	Loch More, Achfary	9·41
,,	Louth, Westgate	1·93	XX.	Dunmanway, The Rectory	3·63
,,	Bawtry, Hesley Hall	1·52	,,	Mitchelstown Castle	2·31
,,	Derby, Midland Railway	1·60	,,	Gearahameen	7·50
VIII.	Nantwich, Dorfold Hall	2·45	,,	Darrynane Abbey	3·20
,,	Bolton, Queen's Park	2·22	,,	Clonmel, Bruce Villa	2·03
,,	Lancaster, Strathspey	2·59	,,	Roscrea, Timoney Park	2·00
IX.	Langsett Moor, Up. Midhope	...	,,	Broadford, Hurdlestown	4·19
,,	West Witton	·90	XXI.	Enniscorthy, Ballyhyland...	2·69
,,	Scarborough, Scalby	1·46	,,	Rathnew, Clonmannon	2·50
,,	Ingleby Greenhow	...	,,	Hacketstown Rectory	3·17
,,	Mickleton	2·20	,,	Ballycumber, Moorock Lodge	2·21
X.	Bellingham, High Green Manor	2·22	,,	Balbriggan, Ardgillan	1·99
,,	Ilderton, Lilburn Cottage	1·30	,,	Castle Forbes Gardens	3·49
,,	Keswick, The Bank	4·68	XXII.	Ballynahinch Castle	5·96
,,	Orton	3·70	,,	Woodlawn	4·43
XI.	Llanfrechfa Grange	2·33	,,	Westport House	3·94
,,	Treherbert, Tyn-y-waun	4·90	,,	Dugort, Slievemore Hotel	...
,,	Carmarthen, The Friary	2·53	XXIII.	Enniskillen, Portora	4·01
,,	Fishguard, Goodwick Station.	2·43	,,	Dartrey [Cootehill]	3·42
,,	Crickhowell, Tal-y-maes	2·00	,,	Warrenpoint, Manor House	2·62
,,	Birmingham WW., Tyrmynydd	2·66	,,	Belfast, Cave Hill Road	4·01
,,	Lake Vyrnwy	2·70	,,	Glenarm Castle	3·18
,,	Llangynhafal, Plas Drâw	2·46	,,	Londonderry, Creggan Res...	3·37
,,	Rhiwbryfdir	10·01	,,	Milford Manse	3·38
,,	Dolgelly, Bryntirion	6·94	,,	Killybegs	6·44

Climatological Table for the British Empire, April, 1919.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	71·0	19	27·4	3	55·1	38·1	39·6	80	119·7	25·7	3·93	18	7·3
Malta	84·2	5	51·0	27	65·9	55·4	...	82	135·0	...	·84	3	5·0
Lagos	99·0	9	72·0	9	88·1	78·4	75·1	76	158·0	63·0	3·96	11	4·9
Cape Town	94·9	16	50·1	20	73·5	57·6	57·1	77	...	...	1·71	8	3·8
Johannesburg	82·0	1	40·1	22	72·6	51·4	48·8	70	...	41·8	1·73	8	2·8
Mauritius	84·4	6	62·2	16	81·3	71·0	67·3	76	...	56·5	2·96	26	6·3
Bloemfontein	84·7	14	42·2	22	76·9	50·9	50·6	66	..	...	1·28	9	2·3
Calcutta...	103·0	13	66·6	9	96·1	75·3	71·0	67	...	63·1	4·02	4	3·5
Bombay	91·5	27	74·5	5	89·0	76·9	73·2	75	132·3	68·0	·00	0	1·3
Madras	98·3	23	73·7	5	93·6	78·7	75·0	75	163·6	71·3	·00	0	2·7
Colombo, Ceylon ...	91·8	3	71·5	11	89·8	76·3	75·2	80	157·9	70·6	5·96	16	6·9
Hongkong	85·9	30	56·8	1	77·1	69·2	68·2	85	...	...	4·43	14	7·9
Sydney	87·9	27	52·3	13	74·7	58·5	57·1	74	137·9	44·5	3·20	15	5·1
Melbourne	83·5	25	40·9	28	72·2	50·6	49·8	65	13 ·2	34·4	·74	8	4·9
Adelaide	93·4	4	47·2	11	78·8	58·1	51·3	53	150·0	37·6	·27	4	5·2
Perth	87·7	10	50·4	17	74·6	58·0	55·7	64	153·4	44·6	·55	4	4·4
Coolgardie	87·8	15	46·8	18	76·5	53·7	48·8	53	149·8	42·8	4·15	7	3·6
Hobart, Tasmania ..	76·7	5	39·5	1	65·5	49·5	46·6	65	123·0	30 6	1·09	9	6·6
Wellington	67·5	2	38·2	16	60·7	49·7	47·8	76	143·0	26·6	1·93	12	6·5
Jamaica, Kingston ..	91·7	13	68·1	26	87·8	72·3	69·6	77	...	...	2·40	5	4·7
Grenada	89·0	8*	73·0	20†	86·0	75·0	...	72	137·0	...	·85	10	4·2
Toronto	62·8	20	9·9	1	50·9	34·3	31·3	69	128·2	8·0	2·89	15	6·5
Fredericton	65·0	28	19·0	2,4,5	49·0	30·4	30·9	71	...	...	2·95	12	6·7
St. John, N.B. ...	52·5	24	20·5	2	44·2	32·2	31·2	77	122·1	20·0	4·37	15	7·4
Victoria, B.C.	67·2	23	36·8	8	55·5	42·4	41·0	79	133·0	26·8	2·90	14	5·8
Bombay Jan. ...	86·7	7	61·1	13	82·7	68·8	64·0	69	133·0	52·6	·11	1	1·5
Bombay Feb. ...	85·1	9	64·0	19	82·6	68·6	64·7	71	130·0	55·3	·00	0	1·1
Bombay March ...	91·0	28	70·7	5	85·1	72·9	69·6	75	129·4	63·0	·00	0	1·1

*12 and 29. † and 22.

Johannesburg.—Bright sunshine 267·2 hours.

Bloemfontein.—The warmest April ever recorded.

COLOMBO, CEYLON.—Mean temp. 83°·0, or 0°·4 above, dew point 0°·5 above, and R 1·11 in. below, averages. Mean hourly velocity of wind 4·0 miles. TSS on 3 days.

HONGKONG.—Mean temp. 72°·5. Bright sunshine, 154·2 hours. Mean hourly velocity of wind 12·5 miles.

Melbourne.—Mean temp. 1°·9 above, and R 1·53 in. below, averages.

Adelaide.—Mean temp. 4°·6 above the average, with two exceptions highest for April in 62 years.

Perth.—R 1·06 in. above average.

Coolgardie.—R about 3 inches above average.

Wellington.—Mean temp. 1°·7 below, and R 2·06 in. below, averages. Bright sunshine, 147·5 hours. Frost on 9 mornings.

Symons's

Meteorological Magazine.

No. 646. NOVEMBER, 1919. Vol. LIV.

BRITISH ASSOCIATION AT BOURNEMOUTH.

METEOROLOGICAL LUNCHEON.

Meteorologists and others interested in weather science gathered together on Thursday, September 11th, at a luncheon held in Linden Hall, Bournemouth. Sir Napier Shaw was in the chair, and among those present were Lady Shaw, Prof. H. H. and Mrs. Turner, Prof. and Mrs. Schuster, Mr. Acland, Mr. P. Y. Alexander, Mr. Wilson Fox and Sir R. Gregory. The Overseas Dominions were represented by Sir Frederick Stupart, Director of the Canadian Meteorological Service, and Lt.-Col. D. C. Bates, Director of the Meteorological Service of New Zealand.

After the usual loyal and patriotic toasts, Mr. Wilson Fox proposed the toast of "Meteorology" coupled with the name of Sir Napier Shaw, who responded.

Mr. J. J. Shaw proposed the toast of "Seismology" drawing attention to the difficulties that had been encountered owing to the war, in that many stations were either inoperative or cut off from communication. The chief station, Shide, was just closed owing to Mrs. Milne's return to Japan, but by a very timely benefaction from Dr. J. E. Crombie, of Aberdeen, in recognition of the unceasing enthusiasm of Prof. Turner, it was now practicable to make a start at Oxford, where Prof. Turner would be able to continue his supervision.

Reference was also made to the help which both Sir Napier Shaw and Dr. A. Schuster had given to Seismology in the past. It was appropriate that meteorology and seismology should be joined at the lunch, since it was of frequent occurrence both here and abroad that seismology had become a protegé of meteorology. The speaker pointed out the need for good observers and co-ordination and believed that the British Dominions alone owing to their geographical distribution could provide the whole of the observation required for a complete investigation of seismology and he specially appealed to their guest, Sir Frederick Stupart, of the Weather

Bureau of Canada, to do what he could in this direction. In conclusion, were it only for the injunction given him by Prof. John Milne, three days before he died, "to carry on with seismology," it gave him much pleasure to propose that toast.

Prof. Schuster responded.

Prof. H. H. Turner proposed "The Guests," coupled with the names of Sir Frederick Stupart (Canada) and Lt.-Col. Bates, (New Zealand). Sir F. Stupart, in replying, expressed his great pleasure in being present. As a Canadian he felt that it was well that those who dwelt in the Overseas Dominions should rub shoulders with their colleagues of the Mother Country. While the Meteorological Services of the British Dominions were autonomous an intimate knowledge of the service of Great Britain was desirable, and this could only be obtained in England. As conditions were to-day, this knowledge could only lead to a very high degree of respect for any opinions and suggestions which might come from the Office presided over by Sir Napier Shaw. The speaker also referred to the increased knowledge of Canada and its people brought about by the war, and in concluding spoke with appreciation of the presence of the Prince of Wales in the Dominions.

Lt.-Col. D. C. Bates also responded to the toast, and remarked that a voyage of fifty-one nights and days separated him from home on the other side of the world, but unity of purpose had drawn them together at this juncture to secure the scientific results won at the cost of so much effort and sacrifice in the great war. Men of science had to safeguard public services at this period of financial stress and political strife. They must stand together to safeguard the treasures won from the past and hand on to the future all that was good, useful and true. There was, of course, great need for economy in the aftermath of war, but it was to be hoped that the best in civilization would not be sacrificed to the cry for money. Ideals were more precious than gold, and scientific men who sacrificed time, pleasure and wealth, must now be ready to join together to carry on their work with even greater energy and zeal. He paid a tribute to the Chairman, Sir Napier Shaw, the doyen of the world's meteorology, who greeted them with open heart and mind, and he trusted British meteorology would always continue to be in the forefront of the world's advance. He regretted the absence of Dr. H. R. Mill from the gathering.

Previous to the luncheon Sir Frederick Stupart read a paper before Section A, on "Some Unsolved Problems in Canadian Weather," making special reference to the climatic peculiarities of the province of Alberta. He referred to the pressure and temperature conditions of two recent consecutive Januaries in which the mean temperatures at Calgary were 16° F. and 17° F. respectively. During the cold January the mean pressure of the month in the north-west of Canada was as high as 30·75 in., but

in the mild January only 29·97 in. In the cold January there was intense terrestrial radiation and light northerly winds prevailed, but in the mild January with the low pressure, Föhn (Chinook) winds persisted, and the temperature in Alberta was high continuously. The Föhn effect was due to the winds from the Pacific having to traverse four mountain chains so that they were dynamically warmed winds. In the discussion that followed Sir Napier Shaw pointed out certain objections that applied to the conventional explanation of Föhn effects.

ON THE DESIGNATIONS: RAIN, SNOW AND HAIL.

By L. C. W. Bonacina.

Of each of the three primary kinds of precipitation falling to the ground from a height, namely: rain, snow and hail, there are numerous varieties, and there are also various transition forms between them. In the case of hail, three of its varieties are so very distinct and characteristic as almost to be entitled to be called sub-species. Thus we have (1) hard or true hail, a complex structure often, though not only, associated with thunderstorms; (2) soft hail, graüpel or grésil, a type of precipitation of which there are endless varieties, common in cold weather, tending towards snow, and often associated with it; (3) ice-rain, which takes the form of more or less clear spherules of ice formed generally during temperature inversions when rain-drops fall through a cold surface stratum of air giving rise to glazed frost. A few years ago I used to regard graüpel as a distinct species of precipitation from hail, and object to the official practice of forecasting it as "hail." But I have since come to the conclusion that it is philosophically correct to regard graüpel merely as a variety or sub-species of hail, and for this reason. If we take the concepts "rain," "snow" and "hail," words belonging to the bed-rock of common language, what do we find to be the specific character of each? The physical criterion of "rain" is the spherical drop of water; of "snow" the separately formed crystal of ice whether it falls alone, in contact with others as a flake, or broken up into dust-like fragments by wind; and of hail the stone or pellet of compact ice. It is clear that ordinary hail, graüpel and frozen rain, however much they may differ in minor respects, have each the fundamental character of being agglomerations of compact ice, and I therefore think they should all be regarded as "hail"—a fundamental species of precipitation on the same footing with "rain" and "snow."

ROYAL METEOROLOGICAL SOCIETY.

At a special meeting of the Society on November 7th at 70, Victoria Street, Prof. V. Bjerknes, of the Norwegian Meteorological Service, Bergen, delivered a lecture on "The Structure of the Atmosphere when Rain is Falling." The President, Sir Napier Shaw, was in the chair.

Owing to the restriction of meteorological data during the war, opportunity was taken largely to increase the number of telegraphic reporting stations in Norway, and to develop Prof. Bjerknes's method of studying atmospheric movements on an intensive scale. The process of mapping air stream lines was described and these were associated by means of a series of extremely instructive lantern slides, with the areas of rainfall. The various types of rainfall were found to be, the orographical, caused by the impinging of lines of air-flow on rising land, setting up ascending currents; secondly, the interaction of drifts of different temperature by means of which (*a*) the warmer current was forced over the flank of the colder which operated similarly to a mountain side, or (*b*) the colder mass of air forced its way as a wedge under the warmer, lifting the latter bodily into the upper strata; thirdly, the development and flow of convection currents giving rise to local showers. The second type of rain, viz., that caused by the meeting of two drifts of air, was that associated with cyclones, and the conception of the cyclone as a spirally moving system was no longer tenable. The lecturer figured the construction of the system in the light of a warm south-westerly wind, striking the flank of cold easterly wind and rising over it, causing rain of a widespread nature without much rise of temperature; the easterly wind passing round the centre of low pressure, subsequently attacked the south-westerly wind on its north-western flank and forcing its way below it gave rise to the squall line in the rear of the system, with the characteristic fall of temperature. This explanation was quite in accord with the conclusions arrived at from different premises by Sir Napier Shaw. Convection effects were described in great detail and the accumulative effect of converging air-drifts as influenced by temperature changes from day to day was vividly set out in a series of maps showing the development of thunderstorms over a considerable area. It was possible to detect the effect of physical features, such as the fiords, glaciers and great lakes, on the air movements. In conclusion the lecturer appealed for a more extensive use of his methods, particularly in the British Isles.

Sir Napier Shaw congratulated Prof. Bjerknes on having carried out in a detailed manner in Norway the work which he had formerly done on a general scale for the United States. Mr. Richardson, of Benson Observatory, Lt.-Col. E. Gold, and Mr. M. A. Giblett, took part in the discussion.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

ROYAL METEOROLOGICAL SOCIETY PHENOLOGICAL RETURNS.

With 1920 the phenological records collected by the Royal Meteorological Society complete the period of thirty years, a recognised critical epoch in Meteorological records.

In consequence of the war, our observing stations had fallen to 110 last year, against the high-water mark of 132, in 1914. We are most anxious now to recover lost ground, and would like to make 1920 preparatory in this respect to the years that follow.

A reasonable total would be at least 220 stations, an average of twenty only for the eleven Meteorological Office districts. At present we are short of this in all districts except England S.E. and the Midlands. The six districts forming Scotland, Ireland and England, N.E. average only three and a half stations each. Wales has two stations only, both in the south-west.

The observations asked for refer to the blooming of thirteen common flowers, and appearance of six birds and six insects. Other migrant records and notes are also invited, but these are of secondary importance.

A copy of the observing form and of a recent report will be sent with pleasure (the reports so far as available) to any of the readers of *Symons's Meteorological Magazine*, who would be interested in helping. We especially suggest the value of these observations to all interested in Nature Study or Regional Survey classes.

Enquiries should be addressed to one of the undersigned, or to the Assistant Secretary, Royal Meteorological Society, 70, Victoria Street, S.W. 1.

33, Holcombe Road, Ilford, Essex. H. B. ADAMES.

"Asgarth," Purley, Surrey. J. EDMUND CLARK.

THE SNOWFALL OF SEPTEMBER, 1919.

The snowfall of September on the Snowdonian range, extended down to 1,200 feet O.D. to the depth of 6 inches. Above 2,500 feet the snow drifted and remained unmelted in a few places for a week, being only some 10 weeks after the disappearance of last winter's drifts. This snowfall extended to a lower elevation than any known to me for the month of September.

J. R. GETHIN JONES.

Bryn Awel, St. Mary's Road, Llandudno, October 13th, 1919.

SEPTEMBER TEMPERATURES.

In the October number the Rev. R. P. Dansey calls attention to the severe frost which occurred at the end of September. At Greenwich the shade reading on the morning of the 29th was 31°, which was 3° colder than any previous record on the corresponding day since 1841, and the reading of 32° on the 30th was 2° below any reading on that day. On September 11th the thermometer registered 87° in the shade at Greenwich, which is 4° higher than any previous temperature on the corresponding day for at least 78 years. The reading of 30°·9 at Greenwich on September 29th, is the only September reading below the freezing point in the screen registered since 1841, with the single exception of 30°·6 on September 27th, 1885. The grass temperatures were respectively 19°·1 last September and 22°·3 in 1835

Mr. Dansey in the letter which you publish says, "September, 1919, closed with severe frost, the exposed thermometer 4 feet above ground on the morning of the 29th registering a minimum of 21°, the lowest September reading recorded in 33 years observations . . ." Is "the exposed thermometer 4 feet above ground" a slip? It is not a recognised meteorological exposure.

I have before me a letter by Mr. Dansey, printed in the *Standard* of October 3rd, 1898, on "a month of contrasts," dealing with exceptionally high and low temperatures in the previous September. September this year also had very divergent temperatures.

CHAS. HARDING.

Meteorological Office, S.W. 7, 31st October, 1919.

WIND IN RELATION TO TIDE.

Mr. Twist's letter, on p. 105, on his experiences in the Bristol Channel, recalls to me my own, which I mentioned in a note in my translation of "Theophrastus on Winds and Weather Signs," p. 35. The author there referred to tidal phenomena and reversal of winds in the Euripus; and in my note I wrote: "the tidal phenomena in question may have had a connection, unsuspected by Theophrastus, with the reversal of the wind. Often in past years have I watched at Chepstow the cessation of a storm, the clearing of the weather, or the shift of the wind coincidently with the beginning of the ebb of the great (though generally misrepresented and exaggerated) tides in the Wye."

Thus my observations at a point some thirty miles further up the same tideway than Minehead, agree in the main with Mr. Twist's: with this variation, that with him the change was generally noticed at the beginning of flood; with me at the beginning of ebb. Many a time, in weather which threatened to interfere with some outing, we said "we will wait till the tide turns." JAMES G WOOD.

11b, Sutherland Avenue, W. 9, November, 2nd 1919.

An aunt who lived in this town for sixty years, used to say, when the sea ebbed, "The wind will fall when the tide turns."

Another old lady in Mid-Devon steadily consulted the tide table for Exmouth to know when the weather would change. My aunt died at 92 years; the other at about 96. They had time for experience! L.J.B.G.

Charlton House, Dawlish, October 17th, 1919.

TETRAHEDRAL HAILSTONES ON OCTOBER 13th, 1919.

On the afternoon of Monday, October 13th, there passed over the Chiltern district of South Bucks a somewhat violent squall accompanied by heavy hail, and showing the long dark roll of black cloud typical of the true line-squall structure. At 2.50 p.m. the disturbance struck the town of Amersham, where I happened to be, and just prior to the veering of the wind a point or two from west, a dense mass of hail literally swooped out of the squall cloud. I was out at the time and avoided immediately seeking shelter in order to examine the shape and texture of the hailstones. I found that all those which I caught on the sleeve of my overcoat were white and opaque, and in shape tetrahedral, showing four triangular faces roughly between $\frac{1}{8}$ and $\frac{1}{4}$ of an inch in length from base to vertex. I believe it is rather unusual for hail to form in regular geometric figures, and it would have been interesting to examine the structure of the stones microscopically to see if they exhibited the usual alternate structure of snow and clear ice. It may be noted, on the other hand, that at 4 p.m. on the following day I observed near the village of Stokenchurch, higher up towards the Chiltern escarpment, transparent spheroids of clear ice, which I took to be frozen rain, a species of frozen precipitation which would appear to be genetically and structurally different from hail, and also from those little snowballs called graupel so common in an English winter. It might be added that the squall of October 13th, which struck Amersham at 2.50 p.m. was observed at Beaconsfiefd at 3.5 p.m., so that it may be estimated that the disturbance was not travelling at a greater rate than about fifteen miles an hour. An hour or so later the line of cumuloform squall cloud surmounted by much anvil-shaped false cirrus was still above the horizon. No thunder was heard on the 13th, nor on the 14th, but during a similar type of shower on the afternoon of the 15th I noted two peals while walking along the Chiltern escarpment above Chinnor.

The whole period, 13th—16th, was bleak and wintry.

L. C. W. BONACINA.

27, Tanza Road, Hampstead, N.W., 3, October 20th, 1919.

Lieut.-Col. B. E. F. Keeling, M.C., R.E.

THE death of Col. B. E. F. Keeling on September 20th, only shortly after his appointment as Director-General of the Survey Department of the Egyptian Government, cuts short a career of great promise in connection with meteorology in north-east Africa, the development of which is so largely owing to Col. H. G. Lyons. Before joining the Survey Department, in 1904, Col. Keeling was attached to the Royal Arsenal, Woolwich, and later to the Metrological Department of the National Physical Laboratory, Teddington. In Egypt, although primarily engaged on duties in connection with surveying and metrology, he was closely associated with the meteorological and magnetic work at the Helwan Observatory, and carried out kite and pilot balloon observations as well as special investigations of the upper air conditions during the monsoon season.

He later took charge of the Physical Service as distinct from the Survey Department, but during the war carried out survey duties in England, France and the Eastern Mediterranean, being severely wounded in France.

His meteorological publications include, besides the annual meteorological report of the Helwan Observatory, reports on the "Climate of Abbassia," "Evaporation in Egypt," and "Terrestrial Magnetism in North-east Africa."

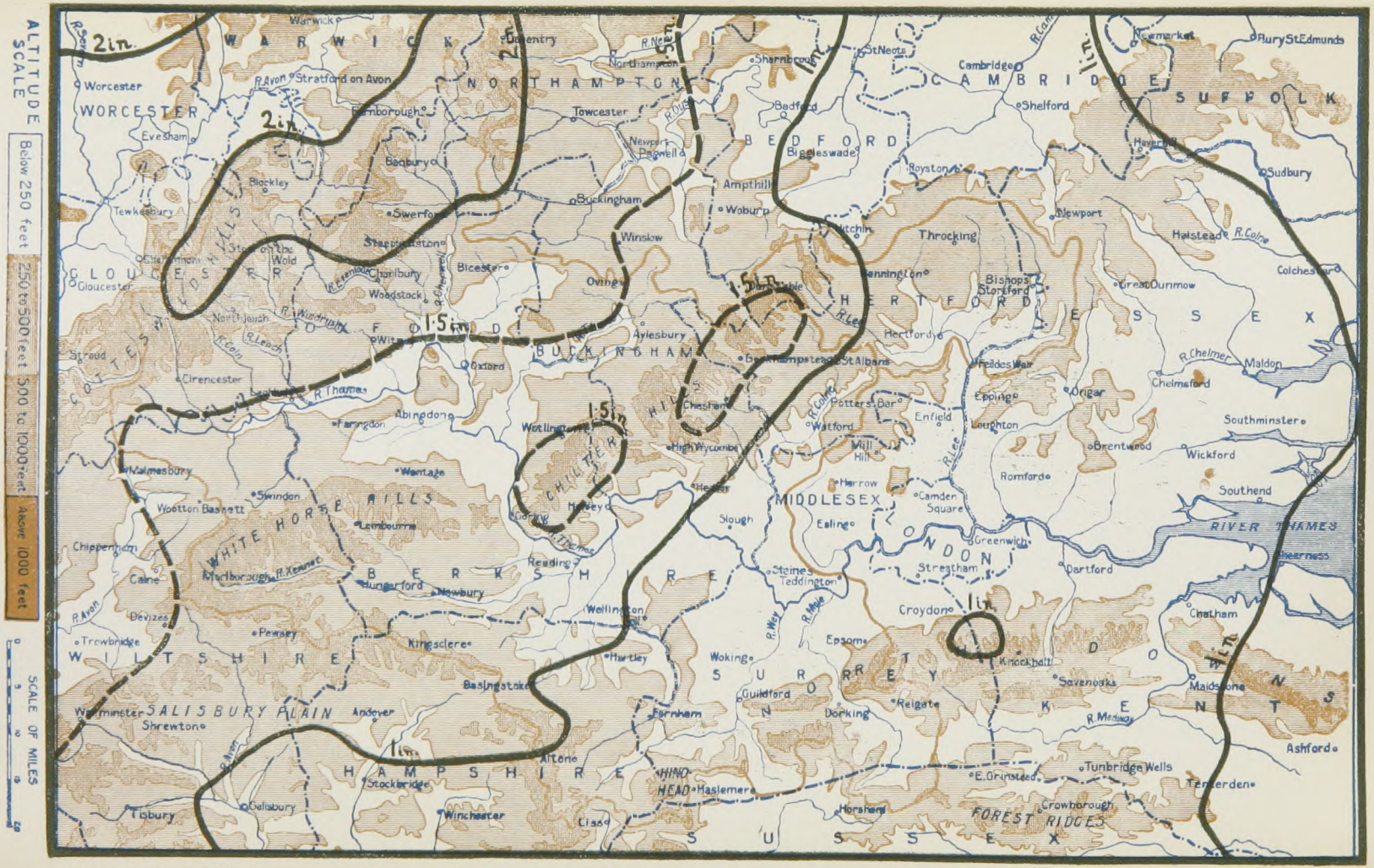
METEOROLOGICAL NEWS AND NOTES.

AN AMERICAN METEOROLOGICAL SOCIETY is being formed and it is proposed that its inauguration shall be definitely taken in hand at the meeting of the American Academy of Arts and Sciences in St. Louis in December, 1919.

MR. R. LAMPORT retired from the staff of the British Rainfall Organization on October 25th after thirty-one years' service. successively under the late Mr. G. J. Symons, Mr. H. Sowerby Wallis, Dr. H. R. Mill and the Meteorological Office. Miss D. K. Lamport has been appointed as a temporary assistant on the staff as from October 27th.

GENERAL TABLE OF "BRITISH RAINFALL, 1918."—Owing to the great demand for this reprint, the stock is already exhausted. Any Observers who do not wish to retain their copies are requested to return them to the Superintendent, British Rainfall Organization, 62, Camden Square, N.W. 1.

THAMES VALLEY RAINFALL. OCTOBER, 1919.



THE WEATHER OF OCTOBER.

ONE of the chief features (one might perhaps describe it as the ruling factor) in the weather of a very remarkable month, was the almost complete absence of the mild and humid south-westerly winds which prevail with so much energy in an ordinary October.

Between the 3rd and 8th of the month, and again from about the 16th to the 22nd, when the distribution of pressure was anticyclonic, the winds were light and rather variable, the days being often bright and sunny, but the nights cold and foggy. These conditions prevailed more especially over England; in Ireland and Scotland the air was milder and clearer, and between the 4th and 6th the thermometer rose slightly over 70° in some parts of North Britain, as well as in the south of Ireland, and touched 73° at Gordon Castle. The sharpest night frosts occurred between the 7th and 14th, when the sheltered thermometer fell in many places, and on at least two or three occasions to 5° or more below the freezing point. On the surface of the grass the lowest readings were observed on the night of the 14th, the exposed thermometer falling to a minimum of 17° at Newton Rigg (Cumberland) and Phœnix Park (Dublin), and to 18° at Blackpool, Rounton, Worksop and Cambridge. Around the middle of the month, and in the closing week, the conditions were cyclonic, but the wind blew mainly from some polar quarter (between N.W. and N.E.), and the weather was therefore cold and inclement, with local falls of snow or sleet and further touches of sharp night frost. The harsh and stormy weather which prevailed between the 27th and 30th was due to a well marked barometric depression which moved in the first place eastward from Iceland, and afterwards southward across the North Sea and France to the western Mediterranean. On the 27th to 29th the northerly winds on the western edge of this disturbance increased to the force of a gale in many parts of Great Britain, snow or sleet fell in places, and a heavy downpour of rain occurred over northern England, the total amount at Rounton (N. Yorkshire) for three days being 2·86 inches. In the English midland and south-eastern counties the unusual coldness of the nights is attested by the fact that at Kew and Nottingham the mean of all the minimum temperatures was the lowest recorded in October for at least 50 years past. At Kew an average of 12 years' observations shews that ground frost does not occur in October on more than 7 occasions; last month it was reported on 19 nights, and at Benson on 23 nights.

Nearly all places experienced more than the average duration of bright sunshine; at Glasgow the total, 104 hours, was 37 in excess of the normal.

A brilliant display of aurora was seen on the night of the 31st as far south as the Isle of Wight.

The rainfall of the month was deficient over the whole of the British Isles with the exception of certain areas in the east, including part of Norfolk, a strip of the coast from the Humber to Berwick, and a portion of north-east Aberdeenshire. More than 5 inches fell locally in these districts. A considerable portion of the south-east of England and small areas in the south-east of Ireland and the centre of Scotland had less than an inch of rain during the month. Apart from the east coast more than 3 inches was confined to the normally rainy districts of the west, but over a large part of the Lake District less than that amount fell. The general rainfall expressed as a percentage of the average was:—England and Wales, 59; Scotland, 57; Ireland, 42; British Isles, 55. Taken generally the month was probably one of the driest Octobers of which there is any record.

In London (Camden Square) the month was dull and cold. The rainfall was the lowest for October in the 62 years record with the single exception of October, 1897. Mean temperature, 45°·7, or 4°·4 below the average, and the lowest for October since 1892. Duration of rain, 22·4 hours. Evaporation, ·61 inch.

RAINFALL TABLE FOR OCTOBER, 1919.

STATION.	COUNTY.	RAINFALL. Aver. 1875—1909. in.	1919. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days
Camden Square	*London*	2·72	·69	—2·03	25	·26	29	9
Tenterden	*Kent*	3·48	1·17	—2·31	34	·37	31	10
Arundel (Patching)	*Sussex*	4·01	·48	—3·53	12	·20	24	5
Fordingbridge (Oaklands)	*Hampshire*	3·97	·70	—3·27	18	·38	24	8
Oxford (Magdalen College)	*Oxfordshire*	2·82	1·37	—1·45	49	·66	24	12
Wellingborough	*Northampn*	2·60	1·52	—1·08	58	·46	23	13
Bury St. Edmunds (Westley)	*Suffolk*	2·72	1·17	—1·55	43	·24	27, 29	12
Geldeston [Beccles]	*Norfolk*	2·84	2·75	— ·09	97	·44	28	19
Polapit Tamar [Launceston]	*Devon*	4·84	1·94	—2·90	40	·27	14, 23	16
Rousdon [Lyme Regis]	,,	3·81	2·03	—1·78	53	1·00	24	11
Ross (Birchlea)	*Herefordshr.*	3·21	2·39	— ·82	74	1·00	23	13
Church Stretton (Wolstaston)	*Shropshire*	3·77	3·25	— ·52	86	1·15	23	14
Boston	*Lincoln*	2·75	1·86	— ·89	78	·52	27	17
Worksop (Hodsock Priory)	*Nottingham*	2·77	2·27	— ·50	82	·76	29	16
Mickleover Manor	*Derbyshire*	2·81	2·46	— ·35	88	1·16	23	10
Congleton (Buglawton Vic.)	*Cheshire*	3·10	2·35	— ·75	76	·66	23	16
Southport (Hesketh Park)	*Lancashire*	3·74	2·87	— ·87	77	1·28	23	12
Wetherby (Ribston Hall)	*York, W.R.*	3·18	3·28	+ ·10	103	·91	23	12
Hull (Pearson Park)	,, *E.R.*	3·19	4·31	+1·12	135	·79	23	17
Newcastle (Town Moor)	*North'land*	3·20	5·63	+2·43	176	1·15	23	17
Borrowdale (Seathwaite)	*Cumberland*	12·71	2·30	—10·41	18	...	...	...
Cardiff (Ely)	*Glamorgan*	4·87	2·47	—2·40	51	1·25	23	12
Haverfordwest	*Pembroke*	5·51	1·95	—3·56	35	·75	23	15
Aberystwyth (Gogerddan)	*Cardigan*	5·38	3·83	—1·55	71	1·86	23	11
Llandudno	*Carnarvon*	3·78	2·98	— ·80	79	1·10	23	12
Cargen [Dumfries]	*Kirkcudbrt.*	4·45	1·51	—2·94	34	·78	23	13
Marchmont House	*Berwick*	3·83	3·32	— ·51	87	1·10	23	14
Girvan (Pinmore)	*Ayr*	5·38	1·70	—3·68	32	·60	22	13
Glasgow (Queen's Park)	*Renfrew*	3·36	·82	—2·54	24	·31	23	8
Islay (Eallabus)	*Argyll*	4·95	2·63	—2·32	53	·65	22	18
Mull (Quinish)	,,	5·87	3·89	—1·98	66	·82	3	23
Loch Dhu	*Perth*	7·53	1·60	—5·93	21	·40	1	11
Dundee (Eastern Necropolis)	*Forfar*	2·81	1·62	—1·19	58	·40	22	15
Braemar	*Aberdeen*	3·88	2·63	—1·25	68	·95	26	17
Aberdeen (Cranford)	,,	3·23	3·12	— ·11	97	·48	22	23
Gordon Castle	*Moray*	3·38	3·74	+ ·36	111	...	...	...
Drumnadrochit	*Inverness*	3·49	1·98	—1·51	57	·40	13	19
Fort William	,,	7·32	3·22	—4·10	44	·86	22	19
Loch Torridon (Bendamph)	*Ross*	8·38	5·56	—2·82	66	·96	26	20
Dunrobin Castle	*Sutherland*	3·15	3·00	— ·15	95	·60	12	12
Glanmire (Lota Lodge)	*Cork*	4·35	·65	—3·70	15	·30	22	12
Killarney (District Asylum)	*Kerry*	5·59	...	...	...	...	...	...
Waterford (Brook Lodge)	*Waterford*	4·00	·39	—3·61	10	·11	23	5
Nenagh (Castle Lough)	*Tipperary*	3·48	·62	—2·86	18	·41	22	9
Ennistymon House	*Clare*	4·40	1·07	—3·33	24	·43	22	9
Gorey (Courtown House)	*Wexford*	3·75	1·51	—2·24	40	·83	23	8
Abbey Leix (Blandsfort)	*Queen's Co.*	3·53	1·11	—2·42	31	·50	23	11
Dublin (Fitz William Square)	*Dublin*	2·88	2·37	— ·51	82	1·25	23	15
Mullingar (Belvedere)	*Westmeath*	3·19	1·50	—1·69	47	·38	23	13
Crossmolina (Enniscoe)	*Mayo*	5·27	2·46	—2·81	47	·39	19	22
Cong (The Glebe)	,,	4·60	...	...	...	...	...	...
Collooney (Markree Obsy.)	*Sligo*	4·21	1·83	—2·38	43	·27	14	15
Seaforde	*Down*	3·65	1·99	—1·66	54	·58	22	14
Ballymena (Harryville)	*Antrim*	3·78	3·41	— ·37	90	·66	13	20
Omagh (Edenfel)	*Tyrone*	3·76	2·25	—1·51	60	·58	22	19

SUPPLEMENTARY RAINFALL, OCTOBER, 1919.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches
II.	Sevenoaks, Speldhurst Close.	·75	XI.	Lligwy	3·21
,,	Ramsgate	1·74	,,	Douglas, Isle of Man	...
,,	Hailsham	·82	XII.	Stoneykirk, Ardwell House...	2·10
,,	Totland Bay, Aston House...	·91	,,	Carsphairn, Shiel	1·47
,,	Stockbridge, Ashley..	·97	,,	Langholm, Drove Road	2·67
,,	Grayshott	·50	XIII.	Selkirk, The Hangingshaw..	3·01
,,	Upton Nervet	1·17	,,	North Berwick Reservoir	2·17
III.	Harrow Weald, Hill House...	·64	,,	Edinburgh, Royal Observaty.	2·37
,,	Pitsford, Sedgebrook	1·59	XIV.	Biggar	2·05
,,	Woburn, Milton Bryant	...	,,	Maybole, Knockdon Farm ...	·61
,,	Chatteris, The Priory	·66	XV.	Shiskine	1·99
IV.	Elsenham, Gaunts End	·73	,,	Ardgour House	4·82
,,	Rayleigh	·68	,,	Oban	2·15
,,	Colchester, Hill Ho., Lexden	1·09	,,	Holy Loch, Ardnadam	2·16
,,	Aylsham, Rippon Hall	3·71	,,	Loch Venachar	1·30
,,	Swaffham	2·12	XVI.	Glenquey	1·90
V.	Bishops Cannings	1·45	,,	Loch Rannoch, Dall	·77
,,	Weymouth	1·85	,,	Blair Atholl	...
,,	Ashburton, Druid House	2·09	,,	Coupar Angus	·88
,,	Cullompton	2·75	,,	Montrose, Sunnyside Asylum.	2·18
,,	Lynmouth, Rock House	1·87	XVII.	Balmoral	2·76
,,	Okehampton, Oaklands	...	,,	Fyvie Castle	5·36
,,	Hartland Abbey	1·81	,,	Keith Station ..	5·25
,,	St. Austell, Trevarna	1·98	XVIII.	Rothiemurchus	...
,,	North Cadbury Rectory	2·01	,,	Loch Quoich, Loan	...
VI.	Clifton, Stoke Bishop	2·88	,,	Skye, Dunvegan	4·29
,,	Ledbury, Underdown	2·58	,,	Fortrose	1·82
,,	Shifnal, Hatton Grange	3·23	,,	Glencarron Lodge	...
,,	Droitwich	2·24	XIX.	Tongue Manse	3·85
,,	Blockley, Upton Wold	2·16	,,	Melvich	2·51
VII.	Grantham, Saltersford	1·91	,,	Loch More, Achfary	6·86
,,	Louth, Westgate	3·00	XX.	Dunmanway, The Rectory ..	1·18
,,	Bawtry, Hesley Hall	2·38	,,	Mitchelstown Castle	1·30
,,	Derby, Midland Railway	2·42	,,	Gearahameen	3·20
VIII.	Nantwich, Dorfold Hall	3·73	,,	Darrynane Abbey	2·76
,,	Bolton, Queen's Park	1·06	,,	Clonmel, Bruce Villa	·46
,,	Lancaster, Strathspey	2·73	,,	Roscrea, Timoney Park	1·16
IX.	Langsett Moor, Up. Midhope	...	,,	Broadford, Hurdlestown	·93
,,	West Witton	4·85	XXI.	Enniscorthy, Ballyhyland...	·78
,,	Scarborough, Scalby	6·36	,,	Rathnew, Clonmannon	1·89
,,	Ingleby Greenhow	6·87	,,	Hacketstown Rectory	·89
,,	Mickleton	3·40	,,	Ballycumber, Moorock Lodge	1·00
X.	Bellingham, High Green Manor	3·87	,,	Balbriggan, Ardgillan	2·29
,,	Ilderton, Lilburn Cottage	4·09	,,	Castle Forbes Gardens	1·81
,,	Keswick, The Bank	2·01	XXII.	Ballynahinch Castle	2·36
,,	Orton	3·03	,,	Woodlawn	1·31
XI.	Llanfrechfa Grange	2·65	,,	Westport House	·90
,,	Treherbert, Tyn-y-waun	2·62	,,	Dugort, Slievemore Hotel ...	...
,,	Carmarthen, The Friary	1·93	XXIII.	Enniskillen, Portora	1·52
,,	Fishguard, Goodwick Station.	2·01	,,	Dartrey [Cootehill]	1·51
,,	Crickhowell, Tal-y-maes	2·00	,,	Warrenpoint, Manor House ..	1·40
,,	Birmingham WW., Tyrmynydd	3·12	,,	Belfast, Cave Hill Road	2·07
,,	Lake Vyrnwy	...	,,	Glenarm Castle	2·21
,,	Llangynhafal, Plas Drâw	4·60	,,	Londonderry, Creggan Res...	1·83
,,	Rhiwbryfdir	4·18	,,	Milford Manse	2·53
,,	Dolgelly, Bryntirion	4·22	,,	Killybegs	2·79

Climatological Table for the British Empire, May, 1919.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	82·0	23	41·6	3	70·8	47·5	48·4	70	125·8	38·0	·33	4	4·5
Malta	77·0	21	49·0	2	67·4	57·3	...	82	134·0	...	·57	6	5·0
Lagos	88·4	24	69·0	9	86·1	75·3	73·8	79	163·5	63·3	8·58	22	8·2
Cape Town	92·2	13	38·0	3	73·2	49·8	49·5	66	...	...	1·51	8	3·2
Johannesburg	71·3	11	31·6	7	64·8	43·3	38·1	66	...	29·2	·07	3	1·8
Mauritius	82·4	3, 9	56·1	22	79·2	65·3	63·3	74	..	49·5	·96	9	5·3
Bloemfontein	73·5	26	30·9	3	67·9	37·7	37·4	66	...	...	·37	1	2·6
Calcutta...	104·6	21	68·4	5	95·7	77·9	75·6	74	...	63·2	4·18	7	3·6
Bombay	93·4	31	78·2	3	91·5	81·3	76·2	74	138·0	·2·0	·00	0	2·9
Madras	108·2	21	76·5		99·3	81·3	73·2	65	165·6	75·2	·03	2	3·3
Colombo, Ceylon ...	89·9	9	72·2	26	87·7	76·8	75·2	82	157·6	71·0	20·01	24	7·9
Hongkong	88·6	21	69·0	24	80·6	73·6	70·7	82	...	...	6·95	13	8·2
Sydney	86·0	1	48·0	31	68·6	56·9	55·6	81	127·4	41·1	23·03	25	7·3
Melbourne	77·8	5	36·8	17*	62·3	46·8	46·8	74	128·5	30·8	1·66	15	5·7
Adelaide	80·7	5	41·7	16	66·1	51·0	49·0	72	140·2	29·8	2·28	13	5·6
Perth	77·1	2	39·7	9	69·0	51·8	49·3	67	136·3	31·7	2·03	8	3·4
Coolgardie	80·2	4	38·0	9	67·1	46·7	44·1	60	138·2	35·8	1·87	4	4·5
Brisbane	76·6	1	51·9	24	72·4	58·9	56·8	76	137·6	43·6	5·47	18	5·4
Hobart, Tasmania ..	71·8	5	35·9	26	57·9	43·5	41·9	70	113·5	30·3	·76	10	5·6
Wellington	63·4	4	33·6	29	57·0	46·2	45·1	79	114·0	...	1·92	9	6·5
Jamaica, Kingston ..	91·5	6	71·1	1	87·0	73·8	72·4	80	...	...	7·04	10	5·5
Grenada	88·0	1†	74·0	3	85·0	75·0	...	78	135·0	...	5·92	21	5·0
Toronto	91·8	29	38·8	8‡	64·6	45·8	43·3	71	126·0	33·9	5·15	14	5·8
Fredericton	78·5	22	26·0	10	63·1	38·5	39·1	61	...	...	5·28	12	5·1
St. John, N.B. ...	73·9	22	34·7	1	57·5	41·3	39·4	71	135·1	28·0	3·94	11	5·0
Victoria, B.C.	68·5	14	39.8	3	59·4	44·9	41·0	69	137·0	31·8	·79	11	5·2
Brisbane April ...	84·3	8	56·9	13	77·7	62·6	60·1	72	147·7	51·6	1·99	14	5·5
Wellington February	81·1	24	44·9	26	69·6	56·9	54·9	75	152·0	...	2·02	3	5·4

* and 27. † and 26. ‡ and 11.

COLOMBO, CEYLON.—Mean temp. 0°·2 below, dew point 0°·2 below, and R 6·87 in. above, averages. Mean hourly velocity of wind 5·1 miles, prevailing direction S.W. TS8 on 8 days.

HONGKONG.—Bright sunshine, 137·5 hours. Mean hourly velocity of wind 11·6 miles, prevailing direction E. Mean temperature 76°·6.

Sydney.—R record for month of May, previous highest 20·87 in. in 1889. Only exceeded on three occasions in any month, the highest being 25·43 in April, 1841. Mean temp. 62°·7, highest on record for May.

Adelaide.—Mean temp. 0°·8 above, R ·44 in. below, averages.

Perth.—R 2·74 in. below normal.

Brisbane.—R above normal, third highest for month in 39 years.

Symons's

Meteorological Magazine.

No. 647. DECEMBER, 1919. Vol. LIV.

John Aitken, LL.D., F.R.S.,

FALKIRK, 1839—13TH NOVEMBER, 1919.

THE death of Dr. John Aitken deprives Meteorology of a very ardent and singularly gifted student. He was a brilliant example of a type which has done much to mould the history of science in Great Britain since the revival of natural knowledge in the sixteenth century. Like Napier of Merchiston, Boyle, Cavendish, Banks, Murchison, Campbell of Islay, and many others, he had sufficient means to devote his best years to scientific investigation untrammelled by the necessity of toiling at a profession or of conforming to the traditions of an institution. An apprenticeship in an engineering works gave him a practical knowledge of mechanical processes which he turned to good account during the many years of quiet country life at Darroch and Ardenlea, near Falkirk, which his uncertain health required. His appearances at meetings of the British Association and various learned societies were infrequent; but whenever he spoke on any of the subjects with which his mind was occupied, he commanded attention by the originality of his methods and the actueness of his observation. He was an adept in devising apparatus to test points of physical theory, and his demonstrations were always as simple and direct as they were conclusive. Had health and circumstances permitted, Dr. Aitken would have been an inspiring professor; but as events fell out he perhaps did more in the way of important investigations by his unaided and unhurried industry than all his hypothetical students might have accomplished.

The summary of his work in "Who's Who," may be taken as his own estimate of the relative importance of his researches and in it he says :—

> "Has investigated and written papers in the publications of the Royal Society, London, and Royal Society of Edinburgh, on 'Colour and Colour Sensation,' 'Rigidity produced by Centrifugal Force, Dust, Fogs and Clouds,' Colour of Water,' 'Dew,' 'Apparatus for counting the Dust Particles in the

Air,' 'Observations on the number of Dust Particles in the Atmosphere of different places in Europe,' 'Hazing effect of Atmospheric Dust,' 'Cloud Particles,' Cyclones and Anti-cyclones,' 'The Sun as a Fog Producer,' etc. Has invented instruments for counting the dust particles in the atmosphere, chromomictors and the Koniscope."

Probably the name of John Aitken will be associated more particularly with the discovery of the place of dust in the functions of the atmosphere, and to the revision of the theory of dews, but his services to experimental meteorology are much more extensive. His valuable researches on the measurement of air temperature have never been fully appreciated by meteorologists and it is to be feared that they are little known. They deal almost exhaustively with the effect of radiation on thermometer bulbs of different size and surface, with the effect of shelter in thermometer screens, the influence of a current of air flowing over the bulbs and the possibility of securing such a current by the use of a chimney of appropriate size and suitable surface.

At the time of his death Dr. Aitken was studying the grass minimum temperatures recorded in different parts of the country this autumn, and in correspondence with the writer of this notice on the discrepancies between the readings at various London stations, his handwriting was as firm and his grasp of the problems of radiation temperatures as sure as they were forty years ago.

To Dr. Aitken his researches were everything. He shrank from public appearances and had no ambition to take a leading part in the conduct of scientific societies. He was equally indifferent to the conventional opinions which dominate so many scientific workers, and cared little for scientific orthodoxy if the plain leading of observation and experiment ran athwart its canons.

In the days of the Scottish Marine Station and the Ben Nevis Observatory, he co-operated with Dr. Buchan, Sir John Murray, Prof. P. G. Tait, Prof. Chrystal and Sir Arthur Mitchell in promoting research in the deep sea and the upper air at a time when those researches were viewed with profound indifference in most parts of this country, and all that he wrote both in those early days and later is well worthy of attention now when the tide of general interest has been directed into the channels where he was a pioneer.

H.R.M.

METEOROLOGICAL OFFICE FORECAST SERVICE.

On November 18th, the Forecast Branch of the Meteorological Office was removed from Exhibition Road, South Kensington, S.W., 7, to The Air Ministry, Kingsway, W.C. 2.

THE USE OF AEROPLANES IN METEOROLOGY.

By C. K. M. Douglas,
Late Pilot of the R.A.F.

The recent development of the aeroplane has provided a method of upper air research, which has some advantages over any other method, as the instrumental observations may be combined with direct observation of cloud formations. The author took part in upper air observations carried out by aeroplanes at Berck, in north-east France, between February, 1918, and May, 1919, in co-operation with the Meteorological Section, R.E., under the direction of Lt.-Col. Gold, D.S.O., F.R.S., primarily for the artillery, but also as an aid to forecasting. The observations included temperature, humidity, visibility and also observations of cloud forms, assisted by the photographic camera. The results achieved showed what might be accomplished if observations were made regularly at a number of stations.

One result of such observations would be an increased knowledge of cloud formations and of their value in forecasting. The clouds have not hitherto attracted the attention they deserve, among most meteorologists, but the application to forecasting of ordinary observations made with the International code is by no means easy. An experienced observer of clouds and of local weather not infrequently makes a more accurate prediction than the forecaster with a synoptic chart, especially in the remoter districts in the west and north. At the same time the enormous advantage of the synoptic method is obvious, when it is realised that our weather may be completely changed within twenty-four hours as the result of a complex series of causes operating over any or every part of western Europe, the eastern Atlantic and the Arctic Sea. Observations of clouds can only be of value in so far as they can be used in conjunction with other observations and add to our knowledge of the dynamics and physics of the atmosphere. Aeroplane observations of the temperature and humidity of the air, combined with the view of the clouds over a vast area which the observer obtains, provide a means both of adding to our knowledge and of making more use of cloud observations in forecasting. The principal object at which to aim is a clearer understanding of the causes of our various weather phenomena—a most fascinating branch of study.

Even so simple a factor as the vertical stability of the atmosphere is of great importance in connection with thunderstorms and allied phenomena. A necessary factor for thunderstorm development is a large temperature difference between the lower layers and the layer between 10,000 and 15,000 feet. Thunderclouds tower up to great heights, well above 20,000 feet in the case of severe storms. If their growth is checked below 12,000 feet no storm will develop, except perhaps in rare instances when the clouds are very low and

there is a very rapid lapse of temperature in the lower layers. No storm of any severity is probable unless the clouds can grow above 15,000 feet. The actual disturbance originates in the lower layers, and is much affected by local features at the surface ; but the favourable condition may exist over a large area, so that thunderstorms may occur in various parts of the country for several successive days, and on another occasion with similar surface conditions they fail to materialise. An unusually violent outburst is usually the result of marked instability, with enough moisture in the lower air to supply the necessary energy.

Figs. 1 and 2 show cumulo-nimbus clouds, with their tops at about 20,000 feet. The first photograph was obtained from 12,000 feet on the evening of July 14th, 1918, and shows a part of a cumulo-nimbus mass which continued for some distance beyond the right of the picture with a typical " anvil " of false cirrus. The part shown in the photograph had recently grown up and was in the transition stage between water-drops and ice-crystals, but it soon afterwards assumed the same appearance as the rest of the anvil (*i.e.*, it consisted of snow). There were extensive low clouds, the day being warm and moist, and the cumulo-nimbus clouds caused heavy rain, but not violent thunder, as there was no marked instability. The thin strips of cloud in the foreground were at 10,000 feet. Fig. 2 shows large cumulus, and cumulus protruding through a layer of cloud at 8,000 feet, the top of the former being at 12,000 feet and of the latter nearly 20,000 feet. There were heavy local showers and a little thunder. The photograph was taken over the sea, looking west, in the evening of September 23rd, 1918, with very low temperature in the upper air, which belonged to a north-west current behind a depression. The base of the clouds was at 2,500 feet, and they easily grew through the layer at 8,000 feet, although the conditions at that particular height were just stable enough to permit of a horizontal sheet of clouds.

It is plainly of great importance to determine the factors which influence the upper air temperature, in order, if possible, to foretell the changes in advance. Mr. W. H. Dines, F.R.S., has shown that the temperature in the upper air is closely related to the pressure, the correlation co-efficients being ·77 at three kilometres, and ·84 at four kilometres.* But these co-efficients, though high, still allow some influence for other factors. The simultaneous observations of wind and temperature in France (some 500 in all) showed that the source of the air supply has a considerable influence on its temperature.

When pressure is low for a few days over Scandinavia and high over, or to the westward of, Iceland, the polar current resulting always causes extremely low upper air temperatures over Britain and north

* Geophysical Memoirs, No. 13.

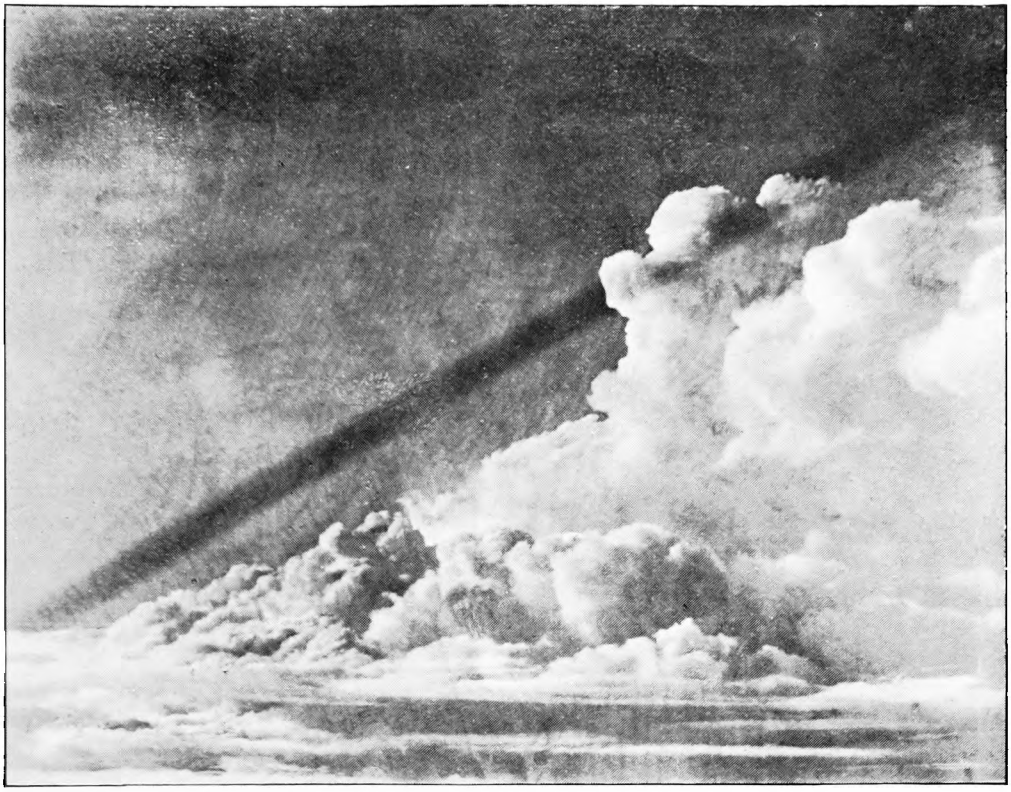


Fig. 1. July 14th, 1918. Cumulo-nimbus up to 20,000 feet.

Fig. 2. September 23rd, 1918. Large cumulus and cumulo-nimbus, protruding through cloud-sheet.

France. The squally showery weather characteristic of the north-westerly currents is a result of the low upper air temperatures, and the tops of the showers frequently exceed 15,000 feet. When the upper air is in steady horizontal motion it tends to change its temperature very slowly, so that a polar current must be cold. Very often a cold current curves round a depression and arrives from south-west, or even south, and in the same way a warm current may curve round an anticyclone. Once cold air is widespread a change of wind may not produce an immediate effect. The result of these considerations and of the dominant effect of the pressure is that north winds at 10,000 feet (3 kilometres) are only on the average a few degrees colder than south winds. But the extreme variations caused by currents from a very cold or warm source are much greater. When deep depressions are passing some distance to north or north-west, the changes due to a succession of warm and cold currents may amount to 15° or 20° F. at 10,000 feet, and the normal relation between the pressure and the temperature at that level may be reversed for twenty-four or forty-eight hours.

Mr. W. H. Dines attributes the relation between pressure and temperature in the upper air largely to air being transferred from the cyclone to the anti-cyclone (during their development) at about nine kilometres, with the result that the air in the cyclone bulges up and is cooled, while the air in the anticyclone is forced down and dynamically warmed. It is possible to accept this theory and at the same time to stipulate that there are other variations due to the origin of the air supply, as the two factors are independent and their effects may be super-imposed. Even in anticyclones, where the relation between the temperature and pressure in the upper air is normally most perfect, there are variations in the temperature and humidity observed at a single station, which are due to the horizontal rather than to the vertical motion of the air. The air which descends is very dry and its lower limit is usually marked by an inversion, *i.e.*, an abrupt rise of temperature for a few hundred feet. But the level and the magnitude of the inversion may vary considerably in quite a short time, and near the edge of the anti-cyclone it may disappear and then reappear again without much change of pressure. In these conditions the warm dry layers probably travel great distances almost horizontally. Again, warm damp layers may exist at any height in an anticyclone, often above a very dry layer, and these layers must owe their warmth to their place of origin, as they cannot have been warmed for some time past. Warm damp layers of great depth, with much medium and high cloud, are often found round the northern boundaries of anti-cyclones, and sometimes in front of depressions. The relation between these warm damp currents and the very cold dry polar currents is a subject of great interest and importance, of which little is yet known. Systematic cloud observations, especially if

combined with regular information of upper air temperatures and humidities, should throw light on the subject.

But we are here concerned less with the forces controlling the large atmospheric movements than with the weather changes resulting therefrom, and their relation to the temperature and cloud distribution in the upper air. These subjects will be further considered in the second half of the article.

(*To be continued*).

Correspondence.

To the Editor of Symons's Meteorological Magazine.

WIND IN RELATION TO TIDE.

I HAVE read with interest the letter from Mr. Twist in the October number of *Symons's Meteorological Magazine* on "Wind in relation to tide," and note that he invites opinions and experiences.

For several years I was a lighthouse keeper at the Chapman lighthouse, situated near Southend, and took particular notice of the winds and tides.

I am inclined to the opinion that the tides do have some influence on the wind, but not to the extent which most fisherfolk will claim for them. For instance, in heavy winds I have repeatedly noticed that no difference of direction or force could be observed, but, on the other hand, with light winds (from force 3 to 6) I have often observed an increase of force with the flood tide with a westerly wind and a decrease of force with the ebb tide; and the reverse for an east wind. I have mentioned this to the mate of the Nore lightship, and he fully agreed with the foregoing statement, and added, that his experience, speaking generally for the English coasts was, that any wind increases with the ide running to windward, and decreases with the tide in the direction of the wind.

At the Chapman lighthouse, I endeavoured to make a tangible statement concerning the direction of wind in relation to tide, but gave it up as hopeless, because the wind's direction would repeatedly change at any state of the tide from high to low water. However, fisherfolk and 'longshoremen will say, the direction of the wind will change under such and such conditions of tide and wind.

GEO. E. DANES.

58, Upperton Road, Plaistow, E. 13., 7th November, 1919.

LIGHTNING FIGURES.

DR. NEWELL'S note in the October number, on "tree markings," on the body of a man killed by lightning, recalled to me a paper by Mr. Symons in *Meteorological Magazine*, vol. **18**, pp. 81 seq., in which, after having cited numerous similar instances, and described a photograph of a then recent case, he came to the conclusion that the markings were "not referable either to a tree, or to photographic action, but simply to the well-known ramification of an electric discharge." As in one instance given one person struck was within a stable, while his companions were outside and all were marked alike, and another occurred on open ground, where there was no tree near, his first conclusion seems inevitable.

This paper was followed on pp. 104, seq, by another, from Prof. Tomlinson, who had read a paper on the subject before the British Association in 1861, and while agreeing with Mr. Symons as to the mode of production of the marks, differed in some details. A further note from Mr. Strachan appeared on p. 120.

I need not do more than give your readers these references, which will show that so far from this phenomenon being unusual, it is of not infrequent occurrence, and is well authenticated.

JAMES G. WOOD.

115, Sutherland Avenue, W. 2, November, 1919.

THE INTENSE FROST OF NOVEMBER, 1919.

A SPELL of severe winter cold in November, like a spell of hot summer weather in the oppositely-placed month of May, is one of the most constant features of the English climate.

In the north of England and Scotland skating-frosts and deep snows in November are common enough, and quite recent years, 1909, 1912 and 1915 were prominent examples. The recent spell of Arctic November weather with minima in Scotland approximating to 0° F. and maxima in places below 20° was chiefly remarkable in this: that its intensity was unusual not only for the *first half* of November, but even for January or February, and it only shows what may be expected given the right conditions of air circulation in the high latitude of Scotland during the period of the low solstice. It is interesting to note, too, that the advance guard of this November invasion of cold arrived as far back in the autumn as the third week in September—around the 20th, when we experienced in a manner far more drastic than usual one of these cold draughts from the polar regions which occur every September as a sure indication of the passing of summer. It will be recalled, also, that October, 1919, was prevailingly bleak and frosty.

L. C. W. BONACINA.

27, Tanza Road, Hampstead, N.W. 3, November 30th, 1919.

SNOW FOLLOWING FINE WEATHER.

In my note to you of March 5th I did not say the above but "A glorious soft warm sunny day, a striking contrast to the previous weather," etc.

Mr. ffarington's tables do not therefore apply. On looking back, I find :—

In 1912—No days answering that description.
1913— „ „ „ „
1914— „ „ „ „
1915—March 6—Very soft and warm, maximum, 55°.
„ 8—Bitterly cold hard N.E. wind, particles of snow.
1916— „ 18—Lovely calm day, best this year, maximum, 54°.
„ 21—Rain all day, turning to snow in the evening.
1917— „ 17—Lovely day, first spring day, maximum, 54°; first with maximum above 50° since January 2nd.
„ 20—Heavy snow, 7—10.30 a.m.
1918—Feb. 23—Lovely warm spring day. No snow followed directly, but a hard bitter N. wind and on the 28th, snow, with wintry weather.

At any time of the year a cold snap is often ushered in, as it were, by a short spell of extra warmth, and *per contra*, the hardest frosts, often occur just before a thaw. There must be some atmospheric condition to account for these facts. CHARLES P HOOKER.

Cirencester, September, 28th, 1919.

ROYAL METEOROLOGICAL SOCIETY.

The first ordinary meeting of the session was held on November 19th, in the Society's rooms, 70, Victoria Street, S.W., Mr. F. J. W. Whipple, Vice-President, in the chair.

Lieut. C. W. B. Normand, of the Indian Meteorological Service, read a paper on the "Effect of high temperature, humidity and wind on the human body." The climatic conditions under which a wet bulb restricted to a certain maximum rate of evaporation and having an initial temperature of 36°·5 C., will neither gain nor lose heat were derived from kata-thermometer and wet-bulb formulæ. The application of these results to the human body was considered, and on the assumption that conditions resulting in a rise of body temperature above 36°·5 C. must be fatal, the upper limits to climatic conditions under which human life was possible were deduced. The scorching and sometimes deadly simoom of tropical deserts was considered to be a case of the onset of a high wind, without necessarily a change of temperature or humidity

converting livable into unlivable conditions. The suggestion was made that an essential feature of heats-trokes may be that a portion of the body has been exposed for a time to air conditions which are above the limit for existence. The wet kata-thermometer and wet-bulb formulæ were found to furnish quite discordant results regarding the behaviour of a wet surface under varying wind velocities and it was suggested that this discrepancy was due to a less efficient wetting of the kata-thermometer bulb and to a consequently restricted rate of evaporation from it.

Dr. Leonard Hill thought that the discordancy between the wet-kata and the wet bulb thermometers was more probably due to sheltering effects than to drying. He believed heat-stroke was caused by fatigue of the sweat glands. In hospitals in Mesopotamia many lives had been saved by covering the patients with wet sheets, which were fanned in order to set up artificial perspiration. He urged the need of further observations and experiments. Captain Evans, R.A.M.C., said his Persian servant had told him that the most effective way to withstand the effects of the simoom was to lie down, burying the hands and face under the clothing, thus shielding the body from the wind, the effect of which was more disastrous than the high temperature. The critical temperature for heat-stroke might vary from 105° to 120° F., or even more in different individuals. He knew cases where patients suffering from heat-stroke had completely recovered from a body temperature of 110° and some had stood 111° with impunity. Lieut.-Col. Martin Flack said that the keynote to perfect health was great vital capacity. A man with good respiratory force got plenty of lung evaporation. A stuffy atmosphere and sendentary life brought about poor evaporatory force and poor vital capacity.

Capt. A. J. Bamford read a paper on "Some observations of the upper air over Palestine." The observations were all made during the last two years. Tables and graphs showed the monthly averages of the horizontal movements at different altitudes over three stations, at one of which (near Ramleh) observations were kept up continuously for a year. Attention was called to the agreement between the results found and the general summary in Prof. Hildebrandsson's "*Mouvements généraux de l'atmosphère.*" These flights were observed for the first few (usually fifteen) minutes with two theodolites, or a theodolite and a range-finder, the upper part of each ascent being observed with a theodolite alone. The paper also dealt with vertical velocities and included frequency curves, showing for each of the layers, 0-2000, 2000-4000, 4000-6000 feet, the number of times in each month that the observed velocities differed from the theoretical ones by not more than 10, 20, 30 or 40 per cent. etc. The lowest layer was appreciably the most varied, and in it differences of 50 per cent. were not unusual, although the average velocity differed very slightly from theory. In the other

layers there was a distinct increase in the compactness of the frequency curves, while the average velocity changed from slightly above to slightly below the theoretical value.

Mr. J. S. Dines said the correctness of the formula given depended on the size of the balloons. He had found that large balloons went up faster than small ones. Mr. F. J. W. Whipple remarked upon the reversal of the north-south component at 10,000 feet. Captain Pick asked if the author had discovered any general rule by which the wind at 3,000 feet could be deduced from that at 500 feet. On the western front there was a persistent westerly drift between 20,000 and 30,000 feet and it would be interesting to know if this feature was observed in Palestine. He suggested deducing temperature gradients from a correlation of surface temperatures with sky face.

A paper by Mr. E. J. Bilham, B.Sc., was entitled "Barometric pressure and underground water-level." The results recently obtained from a study of an experimental wall with autographic registration at Kew Observatory, Richmond, Surrey, were compared with some earlier records obtained by Dr. Isaac Roberts at Maghull, near Liverpool, and by Prof. K. Honda in the neighbourhood of Tokyo, in Japan. As at Kew, the sensitiveness of the water surface at Maghull to pressure changes varied considerably, high sensitiveness being associated with saturation of the soil by previous heavy rainfall. In Japan it was found that in surface wells the water level was not affected by pressure changes, sensitiveness being exhibited by deep artesian wells only. Prof. Honda had pointed out that by determining the sensitiveness of a well to barometric pressure, the extent to which pressure changes affect strata at a given depth below the surface can be deduced. Data for Japan and the British Isles obtained in this way showed marked points of difference.

The following candidates were balloted for and elected fellows of the Society :—Mr. W. Andrews, Lt. C. A. Brook, R.A.F., Capt. R. A. Cochrane, R.A.F., Mr. J. L. Copp, Mr. F. Cruickshank, Capt. I. G. Le R. Diamond, Capt. C. K. M. Douglas, Lt. C. W. Duffield, Lt. F. J. Goodfellow, Mr. R. F. T. Granger, Flt.-Lt. S. B. Holloway, Flt.-Lt. T. C. B. Hooke, Lt. A. W. Isherwood, Mr. W. C. Kaye, Mr. E. W. Kitchin, C.E., Mr. R. Knight, Dr. V. F. V. Lindholm, Dr. S. F. Linton, Lt. A. W. Mackay, Mr. D. J. Mares, Mr. S. Mortimer, Mr. W. B. Murphy, Mr. F. H. Newman, Dr. V. V. Pamana-Sastrin, Lt. R. Stewart and Mr. T. J. Williams.

REVIEWS.

The Study of the Weather. By E. H. CHAPMAN, M.A., B.Sc. Cambridge University Press. Large crown 8vo., pp. xii. + 132. Illustrated. Price, 3s. 6d. net.

MR. CHAPMAN combines the practical experience of the meteorologist, having served on the western front as meteorological officer to the Fifth Army, with a knowledge of just what the schoolmaster wants. The latest volume of the Cambridge "Nature Study Series," is an admirable introduction to the study of meteorology, and should be useful in stimulating interest in the subject wherever it forms part of the school curriculum. From the selection and orientation of an observation post the student is taught to make weather observations, to study cloud forms and sky signs, and to record instrumental observations. The principle and construction of the rain gauge, thermometer and barometer are explained with the aid of laboratory apparatus. It is to be regretted that the author advocates the use of a home made rain gauge constructed to a bad design, which would certainly give rise to loss by outsplashing and failure to catch snow. The construction of weather charts is explained simply, and the cyclone and anticyclone are described. The last chapter introduces the absorbing subject of weather forecasting. Exercises and problems of a varied character are continuously presented to the scholar and the value of the volume is enhanced by many excellent maps and illustrations.

H.E.C.

Principles of Meteorology. By Capt. G. Ota. Tokyo, 1919. Pp. 12 and 5 plates.

CAPT. G. OTA knows all about meteorology. He says so. "I have found the principles and origins of the phenomena of meteorology and that will explain enough all ambiguous points of meteorology." This book appears to be the fruits of twenty years' study as a mariner who has "navigated to and fro nearly every sea." It consists of but twelve slender pages (giving an allowance of about sixteen lines of letterpress per year of experience).

"Spiral ascendant currents" are to Captain Ota what King Charles's head was to Mr. Dick—as David Copperfield says of this, in regard to the memorial, "I thought I saw some allusion to it in one or two places."

The conclusion is all-sufficient, "There is no meteorological phenomenon, but that caused by the spiral ascendant currents, which cause nearly all of clouds, thunder, rain, fog, etc., or they are the part of the spiral ascendant currents. This theory explains every ambiguos (*sic*) meteorological question quite plain."

The illustrations are referred to as "imaginary plans," a truly happy description.

C.S.

METEOROLOGICAL NEWS AND NOTES.

DR. C. CHREE, F.R.S., has been awarded the Hughes Medal of the Royal Society.

SIR NAPIER SHAW will deliver a course of nine lectures on "A General Survey of the Globe and its Atmosphere," at the Meteorological Office, at 3 p.m. on Fridays, beginning on January 23rd. Admission is free.

THE SYMONS GOLD MEDAL for 1920, has been awarded by the Council of the Royal Meteorological Society to Dr. H. H. Hildebrandsson, of Upsala University, in recognition of his distinguished work in connection with meteorological science.

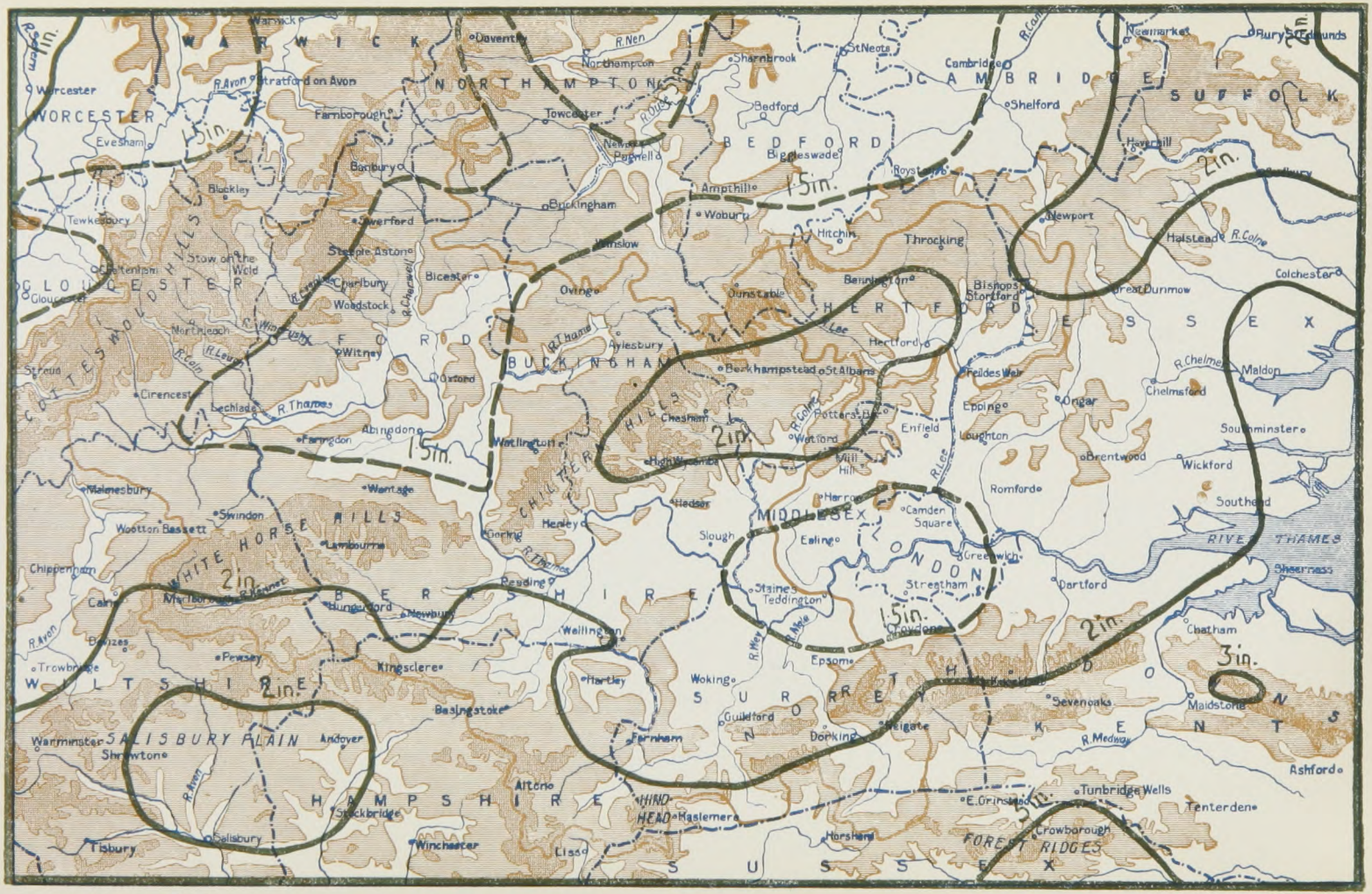
METEOROLOGICAL OFFICE APPOINTMENTS.—The following appointments are notified. Major C. P. Hearle, as Superintendent to establish a meteorological station at Malta. Comm. L. A. Brooke-Smith, R.D., R.N.R., as Superintendent of the Marine Division. Mr. J. S. Dines, as Superintendent in charge of forecasting at headquarters.

MEETINGS AT THE METEOROLOGICAL OFFICE.—On page 106 of the October number of this magazine the dates of informal meetings at the Meteorological Office for the discussion of contributions to current meteorology in colonial and foreign journals were inadvertently given erroneously. The correct dates during 1920 are January 12th and 26th, February 9th and 23rd, and March 8th and 22nd.

THE CONGRESS OF DIRECTORS of Independent Meteorological services recently decided at Paris, by a majority, that the millibar should be adopted in preference to the millimetre of mercury for use in stating the pressure of the atmosphere.

The Directors of Science in Congress assembled,
  Agreed that in future no discord should mar
The values of pressure so often dissembled
  By units derived from a platinum bar.
The inch and the metre and gravity trembled,
  As into the Congress there tripped lightly skipping
An innocent damsel who'd just 'scaped a whipping:
  Her name in plain English was Miss Milly Barr.
    Dear Milly Barr
    Bjerknesian star;
    A thousand of you
    Shall be ever our cue,
  As our standard of pressure wherever we are. E.G.

THAMES VALLEY RAINFALL NOVEMBER, 1919.



Symons's Meteorological Magazine

THE WEATHER OF NOVEMBER.

THE most prominent feature was the unusually severe frost which prevailed in and around the second week, when the majority of places in North Britain recorded temperatures which had not hitherto been observed in November for at least half a century. The month opened with cold easterly and north-easterly winds, but it was not until after the 7th or 8th that the thermometer descended to an exceptionally low level. The sharpest frosts appear to have occurred between the 12th and 15th, when the sheltered thermometer fell slightly below 20° over Eastern and Central England, below 15° at many stations in the western parts of the United Kingdom, and below 10° in Scotland. On the night either of the 13th or 14th a minimum reading of 8° was recorded at Nairn, and 6° at Crieff, while at Balmoral and West Linton the thermometer in the screen recorded 6° below zero F., the minimum on the grass at the former station being 6° below the shade temperature. At many places in the inland parts of Scotland the thermometer on the 14th and 15th remained at least 5° below freezing point all day, and at Balmoral the maximum reading on the 14th was only 10°. The weather during this very cold period was at first fairly dry, but with the advance of a complex cyclonic disturbance, which drifted slowly eastward across the British Isles, snow or sleet fell in all districts; in Scotland the depth of snow in level places was over 6 inches, and at Balmoral as much as 17 inches. Thunder and lightning occurred in the north of Ireland on the 7th and 8th.

The bitter wintry weather was due largely, if not primarily, to the presence of an area of high barometric pressure over the Icelandic region. After the middle of the month, when depressions began to appear in the far north the conditions resumed a more normal character, and, with a shift of wind to the west, temperature rose gradually, but very decidedly. Between the 17th and 19th, and again between the 22nd and 24th, shade maxima exceeding 50° were recorded in most districts, and on the 23rd the thermometer in many places rose considerably above 55°, a reading of 63° being observed at Killarney. In the third week heavy rain fell in Scotland, and on the 20th thunderstorms occurred in Lancashire and North Wales. Towards the close the wind veered, first to the north-west and afterwards to the north, and the weather again became cold, with snow or sleet in several places, and thunderstorms on the 28th in the south-west of England.

The total duration of bright sunshine was in excess of the average in most of the western and northern districts; elsewhere there was as a rule, a slight deficiency.

The rainfall of the month was irregularly distributed, being little more than half the average over a portion of the Thames Valley and in the south of Ireland, but approaching twice the average in the north-east of England, Berwickshire and Aberdeenshire. Rather less than an inch fell in the Upper Severn Valley and less than 2 inches over nearly the whole of the Midland and south-eastern counties, the total rising to more than 6 inches in isolated parts of the Devon-Cornwall peninsula, over a large portion of Wales, and in the Lake District where several stations had more than 10 inches. Over Scotland the normally dry areas in the east showed the greatest excess over the average. Only a small strip bordering the Solway Firth had less than 3 inches, and the greater part of Scotland had more than 5 inches. In part of the Highlands the total reached 8 inches. Over Ireland a large area had less than 2 inches. Elsewhere from 2 to 4 inches fell, except in the west and north where several stations had 6 inches; 8 inches was exceeded in the mountains of Connemara. The general rainfall expressed as a percentage of the average was as follows: England and Wales, 82; Scotland, 110; Ireland, 79; British Isles, 91.

In London (Camden Square) the mean temperature was 38°·9, or 4°·6 below the average. Duration of rain 56·8 hours. Evaporation ·08 inch. Taken together October and November had a mean temp. of 42°·3, the lowest in the 62 years' record, the nearest approach being 43°·1 in 1887.

RAINFALL TABLE FOR NOVEMBER, 1919.

STATION.	COUNTY.	RAINFALL. Aver. 1875—1909. in.	1919. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Date.	No. of Days
Camden Square	*London*	2·34	1·38	— ·96	59	·22	30	23
Tenterden	*Kent*	3·07	2·23	— ·84	73	·38	28	24
Arundel (Patching)	*Sussex*	3·54	2·00	—1·54	56	·38	28	17
Fordingbridge (Oaklands)	*Hampshire*	3·41	2·27	—1·14	67	·54	30	18
Oxford (Magdalen College)	*Oxfordshire*	2·25	1·16	—1·09	52	·31	30	19
Wellingborough	*Northampn*	2·22	1·32	— ·90	59	·36	2	20
Bury St. Edmunds (Westley)	*Suffolk*	2·40	2·21	— ·19	92	·43	17	21
Geldeston [Beccles]	*Norfolk*	2·49	2·07	— ·42	83	·38	2	19
Polapit Tamar [Launceston]	*Devon*	4·07	5·53	+1·46	136	1·12	9	21
Rousdon [Lyme Regis]	,,	3·51	2·47	—1·04	70	·65	30	18
Ross (Birchlea)	*Herefordshr.*	2·77	1·36	—1·41	49	·33	28	21
Church Stretton (Wolstaston)	*Shropshire*	2·94	1·49	—1·45	51	·25	24	20
Boston	*Lincoln*	2·05	2·09	+ ·04	102	·33	3	23
Worksop (Hodsock Priory)	*Nottingham*	1·98	1·65	— ·33	83	·31	3	24
Mickleover Manor	*Derbyshire*	2·21	2·25	+ ·04	102	·40	17	20
Congleton (Buglawton Vic.)	*Cheshire*	2·61	2·27	— ·34	87	·65	17	24
Southport (Hesketh Park)	*Lancashire*	3·16	2·20	— ·96	70	·41	16	16
Wetherby (Ribston Hall)	*York, W.R.*	2·34	1·97	— ·37	84	·57	16	...
Hull (Pearson Park)	,, *E.R.*	2·34	2·98	+ ·64	127	·45	3	27
Newcastle (Town Moor)	*North'land*	2·63	4·48	+1·85	170	·44	9	27
Borrowdale (Seathwaite)	*Cumberland*	13·59	11·70	—1·89	86	...	...	...
Cardiff (Ely)	*Glamorgan*	4·08	3·89	— ·19	95	·81	30	21
Haverfordwest	*Pembroke*	5·16	3·32	—1·84	64	...	...	17
Aberystwyth (Gogerddan)	*Cardigan*	4·50	...	...	...	...	...	..
Llandudno	*Carnarvon*	3·19	1·86	—1·33	58	·28	19	19
Cargen [Dumfries]	*Kirkcudbrt.*	4·35	3·51	— ·84	81	·39	11*	18
Marchmont House	*Berwick*	3·21	6·27	+3·06	195	1·04	25	24
Girvan (Pinmore)	*Ayr*	5·24	4·48	— ·76	86	·70	30	17
Glasgow (Queen's Park)	*Renfrew*	3·63	4·64	+1·01	128	·95	18	16
Islay (Eallabus)	*Argyll*	5·33	5·47	+ ·14	103	·89	23	18
Mull (Quinish)	,,	6·24	4·77	—1·47	76	·64	17	17
Loch Dhu	*Perth*	8·36	7·05	—1·31	84	1·00	16	16
Dundee (Eastern Necropolis)	*Forfar*	2·62	4·77	+2·15	182	·90	23	23
Braemar	*Aberdeen*	3·76	6·25	+2·49	166	·90	9	20
Aberdeen (Cranford)	,,	3·29	5·33	+2·04	162	1·11	7	23
Gordon Castle	*Moray*	2·85	4·51	+1·66	158	...	...	...
Drumnadrochit	*Inverness*	3·41	4·44	+1·03	130	·80	26	17
Fort William	,,	7·55	6·69	— ·86	89	1·25	17	19
Loch Torridon (Bendamph)	*Ross*	8·90	6·54	—2·36	73	1·15	17	16
Dunrobin Castle	*Sutherland*	3·25	4·27	+1·02	131	·75	18	15
Glanmire (Lota Lodge)	*Cork*	4·45	2·25	—2·20	51	·73	30	13
Killarney (District Asylum)	*Kerry*	5·54	3·97	—1·57	72	·70	9	16
Waterford (Brook Lodge)	*Waterford*	3·80	1·63	—2·17	43	·50	30	16
Nenagh (Castle Lough)	*Tipperary*	3·88	2·53	—1·35	65	·49	24	14
Ennistymon House	*Clare*	4·62	3·49	—1·13	76	·54	19	16
Gorey (Courtown House)	*Wexford*	3·41	3·33	— ·08	98	·82	28	22
Abbey Leix (Blandsfort)	*Queen's Co.*	3·28	1·79	—1·49	55	·44	30	17
Dublin (Fitz William Square)	*Dublin*	2·64	3·01	+ ·37	114	·60	14	22
Mullingar (Belvedere)	*Westmeath*	3·38	1·89	—1·49	56	·37	9	15
Crossmolina (Enniscoe)	*Mayo*	5·75	5·62	— ·13	98	·70	8	20
Cong (The Glebe)	,,	5·00	...	...	...	...	...	...
Collooney (Markree Obsy.)	*Sligo*	4·02	4·21	+ ·19	105	·83	25	18
Seaforde	*Down*	3·86	2·48	—1·38	64	·56	30	16
Ballymena (Harryville)	*Antrim*	3·95	3·93	— ·02	99	·78	23	19
Omagh (Edenfel)	*Tyrone*	3·66	4·42	+ ·76	121	·90	23	20

*17 & 30.

SUPPLEMENTARY RAINFALL, NOVEMBER, 1919.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches
II.	Sevenoaks, Speldhurst Close.	2·38	XI.	Lligwy	2·59
,,	Ramsgate	3·65	,,	Douglas, Isle of Man	...
,,	Hailsham	4·24	XII.	Stoneykirk, Ardwell House...	3·47
,,	Totland Bay, Aston House...	2·10	,,	Carsphairn, Shiel	6·33
,,	Stockbridge, Ashley..	2·00	,,	Langholm, Drove Road	4·97
,,	Grayshott	2·30	XIII.	Selkirk, The Hangingshaw..	4·63
,,	Upton Nervet	1·92	,,	North Berwick Reservoir	5·32
III.	Harrow Weald, Hill House...	1·80	,,	Edinburgh, Royal Observaty.	4·99
,,	Pitsford, Sedgebrook	1·57	XIV.	Biggar	4·07
,,	Woburn, Milton Bryant	1·61	,,	Maybole, Knockdon Farm ...	3·37
,,	Chatteris, The Priory	1·50	XV.	Shiskine	4·08
IV.	Elsenham, Gaunts End	2·43	,,	Ardgour House	9·06
,,	Rayleigh	1·55	,,	Oban	5·68
,,	Colchester, Hill Ho., Lexden	1·70	,,	Holy Loch, Ardnadam	5·32
,,	Aylsham, Rippon Hall	3·09	,,	Loch Venachar	4·80
,,	Swaffham	2·61	XVI.	Glenquey	5·80
V.	Bishops Cannings	2·39	,,	Loch Rannoch, Dall	5·70
,,	Weymouth	2·96	,,	Aberfeldy, Dunros	5·15
,,	Ashburton, Druid House	5·43	,,	Coupar Angus	4·29
,,	Cullompton	2·55	,,	Montrose, Sunnyside Asylum.	3·98
,,	Lynmouth, Rock House	4·02	XVII.	Balmoral	5·85
,,	Okehampton, Oaklands	...	,,	Fyvie Castle	4·78
,,	Hartland Abbey	3·67	,,	Keith Station	5·78
,,	St. Austell, Trevarna	4·86	XVIII.	Rothiemurchus	...
,,	North Cadbury Rectory	2·42	,,	Loch Quoich, Loan	14·25
VI.	Clifton, Stoke Bishop	1·99	,,	Skye, Dunvegan	5·96
,,	Ledbury, Underdown	1·44	,,	Fortrose	3·65
,,	Shifnal, Hatton Grange	1·57	,,	Glencarron Lodge	7·40
,,	Droitwich	·83	XIX.	Tongue Manse	6·56
,,	Blockley, Upton Wold	1·78	,,	Melvich	6·41
VII.	Grantham, Saltersford	1·92	,,	Loch More, Achfary	10·00
,,	Louth, Westgate	2·56	XX.	Dunmanway, The Rectory	3·22
,,	Mansfield, West Bank	2·21	,,	Mitchelstown Castle	2·32
,,	Derby, Midland Railway	1·77	,,	Gearahameen	6·20
VIII.	Nantwich, Dorfold Hall	2·04	,,	Darrynane Abbey	3·56
,,	Bolton, Queen's Park	4·03	,,	Clonmel, Bruce Villa	1·85
,,	Lancaster, Strathspey	2·43	,,	Roscrea, Timoney Park	1·55
IX.	Langsett Moor, Up. Midhope	3·39	,,	Broadford, Hurdlestown	2·64
,,	West Witton	3·69	XXI.	Enniscorthy, Ballyhyland	..
,,	Scarborough, Scalby	4·07	,,	Rathnew, Clonmannon	3·75
,,	Ingleby Greenhow	3·50	,,	Hacketstown Rectory	2·12
,,	Mickleton	3·57	,,	Ballycumber, Moorock Lodge	1·64
X.	Bellingham, High Green Manor	6·11	,,	Balbriggan, Ardgillan	2·12
,,	Ilderton, Lilburn Cottage	5·69	,,	Castle Forbes Gardens	2·14
,,	Keswick, The Bank	3·92	XXII.	Ballynahinch Castle	4·55
,,	Orton	6·12	,,	Woodlawn	2·75
XI.	Llanfrechfa Grange	2·61	,,	Westport House	5·18
,,	Treherbert, Tyn-y-waun	6·04	,,	Dugort, Slievemore Hotel	...
,,	Carmarthen, The Friary	3·24	XXIII.	Enniskillen, Portora	3·45
,,	Fishguard, Goodwick Station.	3·03	,,	Dartrey [Cootehill]	2·05
,,	Crickhowell, Tal-y-maes	6·50	,,	Warrenpoint, Manor House	2·03
,,	Birmingham WW., Tyrmynydd	4·93	,,	Belfast, Cave Hill Road	3·94
,,	Lake Vyrnwy	4·55	,,	Glenarm Castle	4·12
,,	Llangynhafal, Plas Drâw	2·70	,,	Londonderry, Creggan Res...	4·44
,,	Rhiwbryfdir	5·86	,,	Milford Manse	5·25
,,	Dolgelly, Bryntirion	4·59	,,	Killybegs	7·09

Climatological Table for the British Empire, June, 1919.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain Depth.	Total Rain Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	84·9	11	41·0	27	72·3	50·7	49·2	63	127·0	36·5	1·51	9	5·4
Malta	95·0	24	61·0	1, 2	80·6	65·9	...	79	144·0	...	·00	0	3·5
Lagos	87·3	2	71·0	21	84·3	74·7	73·6	80	157·3	60·0	8·31	14	7·6
Cape Town	75·9	2	37·1	28	64·1	49·6	50·2	80	...	...	2·99	12	5·6
Johannesburg	73·2	26	36·4	10	62·9	42·9	35·6	62	...	29·3	·00	0	2·4
Mauritius	79·2	13	58·5	19	76·8	64·8	62·8	78	..	52·5	2·36	10	6·4
Bloemfontein	73·9	7	24·3	22	65·3	36·4	34·2	65	...	...	·00	0	3·0
Calcutta...	100·6	2	75·2	1	89·9	79·1	78·4	86	...	71·5	12·94	15	7·0
Bombay	94·0	2	75·6	26	88·4	80·6	77·5	81	134·8	71·3	23·35	20	7·6
Madras	105·0	18	70·2	3	98·8	80·0	70·3	61	159·1	70·5	2·49	12	7·1
Colombo, Ceylon ...	87·7	2, 3	73·7	28	85·9	77·9	75·0	82	151·9	72·0	3·59	19	8·3
Hongkong	90·6	26	76·2	1	87·0	79·4	76·8	83	...	...	10·82	17	7·4
Melbourne	67·2	1	35·0	4	57·1	44·2	42·4	72	106·6	29·0	1·25	15	6·0
Adelaide	72·1	8	38·6	24	63·6	48·6	47·2	72	127·0	27·3	1·78	14	5·5
Perth	79·2	4	39·4	18	64·6	49·1	...	...	129·7	30·7	5·69	16	5·7
Coolgardie	74·8	5	35·8	21	63·6	44·5	42·0	60	132·8	33·2	1·07	3	5·0
Brisbane	77·1	16	43·4	20	69·0	53·6	50·9	68	128·9	32·0	·78	11	4·4
Hobart, Tasmania ..	64·5	1	33·4	30	53·9	43·2	38·8	66	105·7	28·8	3·28	19	6·7
Wellington	65·9	12	29·9	1	54·9	43·0	42·5	79	114·0	...	2·44	15	5·2
Jamaica, Kingston ..	92·1	10	72·2	25	88·8	74·4	72·0	77	...	...	·45	3	5·6
Grenada	87·0	4	72·0	8	84·0	75·0	...	76	134·0	...	4·39	18	5·0
Toronto	94·4	14	47·2	28	83·4	61·3	60·2	70	129·9	43·2	2·72	8	2·9
Fredericton	90·0	6	30·0	1	75·4	48·0	52·4	65	...	...	2·33	6	3·7
St. John, N.B. ...	83·5	4	37·3	1	64·7	47·6	48·2	76	132·6	33·7	2·90	10	5·0
Victoria, B.C.	70·0	12	42·8	7	61·8	46·9	45·0	73	137·0	36·0	·53	7	4·6

Johannesburg.—Bright sunshine, 260·0 hours.

Mauritius.—Mean temp. 1°·1 above, dew point 1°·6 above, relative humidity 1·3 above, and R ·43 in. below, averages.

COLOMBO, CEYLON.—Mean temp. 0°·3 above, dew point 0°·3 below, and R 3·72 in. below, averages. Mean velocity of wind 6·6 miles per hour, prevailing direction W.S.W.

HONGKONG.—Bright sunshine, 203·5 hours. Mean velocity of wind 8·4 miles per hour, prevailing direction S. Mean temperature 82°·6.

Adelaide.—R 1·31 in. below normal.

Perth.—R 1·32 in. below normal.

Coolgardie.—R 0·17 in. below normal.

Wellington.—Bright sunshine 134·3 hours. R 2·62 hours below average.

Symons's Meteorological Magazine.

No. 648. JANUARY, 1920. Vol. LIV.

SYMONS'S METEOROLOGICAL MAGAZINE.

The present number completes Volume **54** of *Symons's Meteorological Magazine*, and marks also the end of a phase in its long history. Founded in 1866 by the late Mr. G. J. Symons as a means for the prompt publication of rainfall statistics for the British Isles, in continuation of the "Rainfall Circulars" issued for two or three years previously, the Magazine rapidly extended its scope to embrace the whole field of meteorological science. Although circulating in all parts of the world, *Symons's Meteorological Magazine* has always kept to its founder's original aim of being primarily the organ of the British Rainfall Organization and as such the medium for the discussion of meteorological matters from the point of view of the large body of volunteer Observers who have given British Climatology such a unique character.

Throughout the greater part of its career there can be no question that the Magazine has carried out this object the more effectively by being entirely under the personal control of its successive editors. It played a large part in bringing into being and encouraging the corps of voluntary meteorological Observers in the British Isles, and that in the course of time official meteorology in this country came to build largely upon this firm foundation is a tribute to the foresight and wisdom with which Mr. Symons shaped his policy.

In July, 1919, when the British Rainfall Organization became part of the official meteorological service of Great Britain, the continuance of this magazine on its present lines, with the general aim of promoting among Observers interest in the science of meteorology, was secured by agreement. In 1916 the Meteorological Office had commenced the publication of a leaflet, for distribution principally among observers, entitled the "Meteorological

Office Circular." This provided a convenient means for the publication of official notices, changes in the observing staff, brief reviews of recent publications and other matter of general meteorological interest. It has now been decided that it is no longer necessary to continue the "Meteorological Office Circular" as a separate publication, and arrangements have accordingly been completed for the amalgamation of the two periodicals under the title of "The Meteorological Magazine." In order to avoid any unnecessary break of continuity the new combined magazine will be issued in 1920 as volume **55**. Mr. M. de Carle S. Salter, Superintendent of the British Rainfall Organization, to whom *Symons's Meteorological Magazine* has been entrusted since the retirement of Dr. H. R. Mill, in July, 1919, will be joined in the editorship by Mr. F. J. W. Whipple, Superintendent of the Statistical Division of the Meteorological Office.

Whilst becoming, as a matter of course, the organ of the combined meteorological services, the Magazine will, it is hoped, fully maintain its traditional character, as a channel of communication between amateur meteorologists.

The design for the new cover, a reproduction of which forms the frontispiece of this volume, was drawn by Mr. W. Hayes, and embodies suggestions due to Sir Napier Shaw. The bringing together of the four portraits, respectively of Admiral Fitzroy, Edward Sabine, Sir Richard Strachey and George James Symons, symbolizes effectively the convergence into a common track of the work of these pioneers of meteorological science and organization.

MACEDONIAN METEOROLOGY.

THE following notes describing meteorological phenomena of a local nature in Macedonia have been forwarded to us by Mr. A. Harrison, who has recently returned to England after two and a half years on the Salonica front.

MOUNTAIN CLOUD.

During the winter of 1916-1917 a heavy canopy of cloud enveloped the summit of the Belashitja range continuously for some fifteen days. The wind was moderate from the north and it appeared to me that the small amount of moisture in the air current was condensed on the snow-capped peaks and poured over to the southern side.

By day the cloud spread to the Zenith, but at night it decreased, until by dawn, only a narrow line of cloud remained. Sometimes a thin film of snow fell on the higher slopes. The cloud finally dispersed at the commencement of a period of broken weather.

Cloud Formation in Salonica.

On a clear bright day in March, 1918, artillery fire caused a dense column of black smoke to arise from a village on the Struma plain. The pillar ascended in a straight column to a great altitude finally spreading out in a canopy above. The air was motionless and visibility remarkably high. Soon, just above the smoke canopy a small white cumulus appeared. This steadily increased in size and about an hour later presented a massive appearance suggestive of a thunder-shower. Then the smoke column began to thin and at the same time the cloud stood out boldly against the clear blue. At about 5 p.m. a light breeze from the west drifted the cumulus away in an easterly direction. This is a clear case of an ascensional column of moisture laden air (the sky otherwise being quite cloudless) producing a cumulus cloud.

Thunderstorms in Macedonia.

Thunderstorms were of frequent occurrence during the month of May both in 1917 and 1918 among the hills. They were all of local origin, occurring between the hours of 2 and 5 p.m. Cumulus formed on the summits of the highest mountains, increasing steadily, until suddenly becoming condensed, when heavy rain and hail fell, accompanied by lightning and thunder. Generally the storms were of small compass and moved along the course of the Struma, several raging at once within a small area. The clouds were of great altitude, as lightning flashes overhead were not followed by thunder before ten or twelve seconds had elapsed and then the sound was muffled and indistinct. At sunset the sky was clear. The storms were mainly preceded by sharp gusts of wind.

In August, 1917, during a hot rainless spell a heavy cumulus suddenly formed over Lake Doiran. It assumed a nimbus appearance and considerable thunder and lightning took place. The cloud mass passed on overhead, with muffled thunder and every appearance of rain, but none fell. Rain had not fallen for some days before this, neither did any occur until five weeks later. The wind was westerly and the air dry, whilst the temperature maximum averaged about 95°. Could it be that the rain was evaporated before reaching the earth?

The autumn thunderstorms were more of the "travelling" kind, coming in from the sea and were always accompanied by a lot of wind. Watching the approach of such storms, I have heard thunder at a distance of twenty miles, there being some hundred seconds elapse between flash and peal. The thunder was remarkably audible, but perhaps the sea carried the sound across and the neighbouring hills caught the vibrations, acting as a sounding board.

THE RAINFALL OF 1919.

A PRELIMINARY survey of the 3,000 returns of rainfall in 1919 up to the present received enables us to form some idea of the general distribution of the year's fall in relation to the average. For this purpose we have confined ourselves to examining such records as have been carried on for a sufficient period to yield average values for 35 years. Of these some 230 are so far available.

The rainfall over England was nearly everywhere in excess of the average, the only important exception being in the north-west, but the excess was nowhere large, only reaching 10 per cent. in scattered patches, the largest of which extended from Malvern to the coast of south Lincolnshire. In the centre rather more than 20 per cent. excess occurred in Leicestershire. The English wet area was continued westward across North Wales, where part of Denbigh and Flint had more than 10 per cent. excess, but in South Wales the severe drought of the summer and autumn brought the year's rainfall well below the average, the deficiency being more than 10 per cent. in place. Parts of the east and north of Scotland had more than the average fall, the wettest districts being northern Aberdeenshire and the Orkneys, but from Inverness southward throughout the Scottish Midlands, and well into the north of England, the rainfall of the year was considerably below the average, the deficiency culminating in central Inverness-shire and Perthshire, where it exceeded 20 per cent. In Ireland the only areas with rainfall above the average were parts of the northern counties and a small patch in Co. Kildare. In the centre and south the fall was more than 10 per cent. below the average, the deficiency being more than 20 per cent. in Co. Cork and in eastern Galway and Kerry.

The general rainfall for the greater divisions of the country during each month was as follows :—

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Eng. & W...	155	103	196	124	41	62	74	85	79	59	82	155
Scotland ..	94	38	105	138	41	139	36	86	112	57	110	130
Ireland	122	69	112	72	120	105	45	81	97	41	79	156
British I. ...	124	71	143	113	62	96	55	84	94	54	91	147

Taking the British Isles as a whole the year, although by no means exceptional, was probably the driest since 1908, a result largely due to the persistent shortage of rain during the summer and autumn. The general rainfall calculated from about 200 stations was

England	33·59	in. or	103	per cent. of average.
Wales	44·61	,,	98	,,
England and Wales.....	35·59	,,	102	,,
Scotland	40·70	,,	92	,,
Ireland	35·81	,,	90	,,
British Isles	37·03	,,	96	,,

Fig. 3. Thunderclouds developing, August 25th, 1918.

Fig. 4. Cloud-sheet at 2,500 feet, February, 3rd, 1919.

THE USE OF AEROPLANES IN METEOROLOGY.

By C. K. M. DOUGLAS,
Late Pilot of the R.A.F.

(*Continued from p.* 130).

Reference was made in the previous article to the frequency of temperature inversions within or at the boundaries of anticyclones, which were attributed to the presence of layers of air which had descended and been dynamically warmed.

These inversions are an effective check to convection and mechanical churning, and in consequence the clouds are usually spread out in a horizontal sheet with the upper surface just below the inversion. The height of the inversion is often 8,000 feet or more near the north-east boundary of the anticyclone, but is lower near the centre. Showers or drizzle may develop below an inversion when the humidity is high. The showers are particularly apt to form when cold air is passing over a warmer sea, but they do not, as a rule, extend very far inland. On the south-west side of the anticyclone the warm dry descending air is usually close to the ground, but in summer over the land there is no inversion owing to the surface heating. This part of the anticyclone is often cloudless, but fogs are not infrequent in winter or over the sea.

In winter, east or north-east winds are often accompanied by cloud-sheets, with inversions above them, at the southern boundaries of anticyclones, or just outside them. Fig. 4 shows such a cloud-sheet with its upper surface at 2,500 feet moving from north-east, on February 3rd, 1919, in a spell of very cold cloudy weather. The ripples are across the current, and there is also a curious ridge in the background from north to south, which was thirty miles long. There are thin patches up above at 10,000 feet, which have some resemblance to cirrus, though they consisted of super-cooled water-drops. The photograph was taken from 5,000 feet, looking west over the sea, from a point five miles inland.

Even when there is no inversion there is not infrequently a comparatively stable layer at about 6,000 to 8,000 feet, which checks the growth of cumulus clouds. When the upper air is stable and also of low relative humidity, widespread or heavy rainfall cannot develop. But if the upper air is warm and damp, rainfall is quite common. A good deal of the rainfall in front of depressions is supplied by warm damp currents. J. Bjerknes,* of Bergen, has shown that the warm air is pushed out in the form of a wedge over cold air in front of the depression, causing rain; while the cold current behind the depression pushes under the warm air, also in the form of a wedge and causes another rainy area. These conclusions were reached as the result of detailed examination of the

* The Structure of Moving Cyclones, by J. Bjerknes. Monthly Weather Review, Vol. 47, No. 2, (February, 1919), pp. 95-99.

surface winds combined with cloud observations, and they are confirmed by the observations of temperatures, clouds, and upper winds made in France. The cold air in front of depressions is less frequently present in France than it is further north, but there were a few occasions when there was a mass of cold air which belonged originally to the north-west current of a previous depression, and a warm current which pushed over it and caused rain. When the high and medium clouds come over before the rain the upper air temperature (*e.g.*, 10,000 to 14,000 feet) rose considerably, although in the lower air there was little or no increase. Sometimes the warm damp upper current which brings the rain is from north-west, having curved round from south-west, the colder wedge below moving slowly from south or south-west. Rain is much more likely to develop near the south-east boundary of a depression if there is cold air in front of it than when there is a large anticyclone, which is always warm (except close to ground in winter). The undermining of the warm air by the wedge of cold air along the trough of a depression was frequently observed in France, usually somewhere in the south-east quadrant, the cold air having curved round. The fall of temperature and veer of the wind (which may be slight) begins near the surface and works up. Behind the rain there is medium and high cloud in a wedge above the cold air and moving from a more southerly point, tapering away into a thin edge. Once the cold air is about 10,000 or 12,000 feet thick, showers frequently develop. On September 23rd, 1918, there was heavy rain in the early morning, and a few showers about noon, when the wedge of cold air was 10,000 feet thick, and much heavier though local showers in the evening when the cold air was over 15,000 feet thick, and Fig. 2 (reproduced in the previous number) was obtained. Two photographs taken at about the same time were reproduced in the *Journal of the Scottish Meteorological Society* (Vol. xviii, No. 35, 1918), showing false cirrus being carried away by a strong upper west-south-west current at 20,000 feet (above the cold wedge) and an anvil with a very flat top at that level. The effect of the upper current is just visible at the top of the cumulo-nimbus in Fig. 2.

No rule can be laid down as regards the upper air temperature in any particular part of a depression, as either warm or cold air may curve a long way round it. The north-west current is almost always cold. By "warm" it must be understood that what is implied is a temperature above the average corresponding to the pressure. A good deal of rainfall may be attributed to warm air pushing over cold air (or cold air undermining warm air) in a large variety of conditions. As air above the influence of the surface variations often only changes its temperature slowly and may follow a complicated path, there is a large variety of possible temperature distributions. This is borne out by the complexity of wind currents. The relation between the upper winds and the distribution of upper

air temperature and pressure are given in chap. vii. of Sir Napier Shaw's *Manual of Meteorology*, Part IV, on the assumption that the wind balances the pressure gradient at its level. The sequence of upper wind and temperature changes in France were consistent with that assumption, though there were a few cases where warm damp upper north-west currents in front of depressions may have had an outward component. Unfortunately the upper air temperature observations in other localities, which are required in order to confirm the existence of the outward component are wanting.

Steady rain due to this pushing of warmer air over colder air may fall from a fairly high level, from a uniform layer of clouds, without any "bumpiness" at all. This is frequently the case at the commencement of cyclonic rains, though low clouds afterwards develop. The rain-clouds extend up to a great height, usually to the cirrus.

The heavy rain sometimes experienced near or at the centre of depressions must often be due not to warm air being displaced by colder air, but simply to air converging at surface and rising up the cold core of the depression. For instance, there was very cold air on both sides of the centre of the depression which caused the heavy snowstorm of April 27th, 1919, and the whole area of the depression was certainly very cold, the heavy snowfall being due to the instability. The few days at the end of April were colder at 15,000 feet than any during the previous winter, except a few at the end of March. Depressions which move from a northerly point are always extremely cold, but the rainfall is not always heavy, being sometimes limited to showers. In order to understand rainfall development, a thorough investigation of the surface currents should be combined with upper air observations. The same is true for investigations of thunderstorms. Prof. V. Bjerknes, in a recent lecture to the Royal Meteorological Society, showed that thunderstorms often develop over points or along lines where the surface currents converge. The researches of J. Fairgrieve point to the same conclusion, and also to a wave structure in the movements which start the disturbance. The convergence of the lower currents lifts the strata above them and if there is a damp layer clouds form, which may grow into thunderstorms. The author has frequently observed the clouds first appear in a wave form, evidently due to an upward bulge, not to upward currents from the surface. Of course frequently the upward currents do start at the surface, but on other occasions the lower air may be quite stable and clouds appear at about 5,000 or 6,000 feet, which afterwards develop into thunderstorms. Fig. 3 shows clouds which developed with their base at 5,000 feet and developed upwards, the lapse of temperature above them being greater than the adiabatic for saturated air, though the lapse below them was less than the adiabatic for dry air. There was another layer above them at 10,000 feet, and the lower layer

had reached it in places. Ultimately the clouds developed into cumulo-nimbus causing moderate thunderstorms with their tops above 15,000 feet. The photograph was obtained over the sea looking west on the evening of August 25th, 1918. The upward movement was started by convergence in a small secondary. Clouds with turreted tops similar to the lower clouds in the photograph may develop high up (*viz.*, 15,000 to 20,000 feet), and indicate instability at those heights, which is a favourable factor for thunderstorm development. But this development can only take place when a layer of cloud is formed below 10,000 feet. A warm damp layer at about 5,000 feet is a favourable condition for thunderstorms. A southerly current may bring about such a condition provided that the air at 5,000 feet is not drawn from an anticyclonic source, in which case it would be too dry for clouds to form. Sometimes a warm damp southerly current has a cold surface north-east current under it, and variations in the depth of this cold current may cause the upward bulge which starts the cloud development.

When clouds form at a temperature of 55° or 60° F., the heat given out by condensation is so great that the clouds grow up if there is merely a normal lapse of temperature above them. When thunderstorms develop in cold weather it is usually found that the lapse of temperature from the surface to a great height is little below the adiabatic for dry air, so that the clouds grow to a great height in spite of the small amount of heat liberated by condensation.

A large number of upper air observations in thunderstorm conditions have already been made. A careful investigation of the wind currents in the lower air which start the disturbance, together with the causes of the favourable distribution of humidity and temperature up above, is the most fruitful line of research, and this can only be done by the combined effort of a powerful organization.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

WIND IN RELATION TO TIDE.

Referring to the communication on the above subject in your October number, it would, I think, be worth while asking Observers in the Conway Valley for evidence. Some years ago, when I spent several holidays at Llanbedr, near Tal-y-Cefn, there were many occasions when the wind appeared to shift with the turn of the tide, often to the opposite direction. F. R. WALTERS, M.D.

Pinecroft, Farnham, Surrey, November 18th, 1919.

SEVERE WINTERS.

At the threshold of winter there is usually a good deal of curiosity as to what the season may bring forth, meteorologically. An inquiry into the distribution of severe winters in the sunspot cycle might conceivably be helpful. Suppose we take the ten coldest winters at Greenwich since 1841, measuring by the mean temperature of the months December to February. The following are all the winters with mean temperature under 37°·0 in descending order (coldest first) :—1891, 1879, 1847, 1845, 1895, 1855, 1917, 1880, 1886, 1871 (1891 meaning 1890—1891 and so on). I will now specify these in the position they take in the following schedule :—

1	Min.	1	2	3	4	5	6	7	8	9
'55		'79	'91		'47		'95		'86	
			'45		'17					
			'80		'71					

It will be seen that seven of those ten winters occur in the four years following minima; that is, roughly, at a time when the sun's spottedness is growing, (the maximum is reached in about three to five years after the minimum) and three remain for the rest of the cycle, as shown. As we have now to do with the seventh year after a minimum, (1913), we are at a part of the cycle less "frequented," apparently, by those severe winters; but the induction is, of course, not a large one. The seventh year has none of the ten, and curiously its history in the previous six sunspot waves, shows no winter colder than 39°·3, which is but a trifle under the general average (39°·5).

We might take another view, by considering all winters under the higher limit of 38°·0—a total of twenty-two. The following table shows the numbers in each category (*a.*), and the result of smoothing with sums of 3 (*b.*) :—

	1	Min.	1	2	3	4	5	6	7	8	9	[10	11]
(*a.*)	3	0	1	3	2	5	1	2	0	2	2	[0	1]
(*b.*)		4	4	6	10	8	8	3	4	4			

The lower series indicates a wave culminating in the third year after minimum.

ALEX. B. MacDOWALL.

Bellevue, Bridge of Allan, 4th December, 1919.

SNOW FOLLOWING FINE WEATHER.

I should like to point out to Mr. Chas. P. Hooker that I have only followed in my remarks on this subject the received heading as above.

As in his last example, in 1918, snow followed five days later, he must not claim that example as a success.

H. NOWELL FFARINGTON.

Worden, Leyland, Lancs, January 3rd, 1920.

ROYAL METEOROLOGICAL SOCIETY.

THE usual monthly meeting was held on Wednesday, December 17th, in the Society's Rooms, 70, Victoria Street, S.W., Sir Napier Shaw, F.R.S., President, in the Chair.

A paper by Mr. F. J. W. Whipple, M.A., entitled "The Laws of Approach to the Geostrophic Wind," was read. The mode of transition from the winds near the surface of the earth to the general current at moderate heights has been discussed by various authors. In the present paper stress is laid on the geometrical aspect of the question. The term "Relative wind velocity" being used for the velocity which must be combined with the geostrophic wind velocity by vector addition to give the actual wind velocity at any level, the laws of approach to the geostrophic wind are :—1. the relative wind turns uniformly with increasing height ; 2. the relative wind decreases with increasing height according to the exponential law ; 3. the actual wind at the surface and the relative wind there are inclined at 135°. The modification of the "laws" when departures from the ideally simple conditions they pre-suppose are allowed for, was discussed.

In the discussion which followed, Capt. D. Brunt called attention to Sverdrup and Heselberg's investigations in which the spiral is followed out nearly up to the height at which gradient direction begins and then tends to shoot off to the right. Mr. L. F. Richardson said that Eckman first discovered the equiangular spiral in 1905. He hoped Mr. Whipple would further generalize the spiral to fit the case in which eddy winds varied with height. The rapid variations in the first ten metres was often clearly shown by frozen snow on telegraph poles. Lieut.-Col. E. Gold said that the increase of velocity at relatively low altitudes was more rapid by night than by day. He had repeatedly found that at night the wind rose to a maximum velocity at 1,000 feet and then decreased ; this did not often happen in the daytime. Sir Napier Shaw said that Mr. Whipple's paper would be a useful appendix to Maxwell's "Matter and Motion."

Mr. G. M. B. Dobson, M.A., read a paper on "Winds and Temperature Gradients in the Stratosphere." From the results of temperature observations by "ballons sondes" it can be shown that the horizontal pressure gradient and therefore the wind velocity should decrease rapidly on passing from the troposphere to the stratosphere. Previously there had been little confirmation of this by actual observations. Seventy ascents recorded by the International Commission gave data for temperature, wind velocity and wind direction to great heights. These showed that almost without exception, winds of moderate or great velocity in the troposphere, fell off very rapidly on entering the stratosphere, while the wind direction remained constant. On days with small pressure gradients this effect was not usually found ; a result which was to be expected.

since the slope of the tropopause would then not necessarily be towards the low pressure. Horizontal pressure and temperature gradients calculated for the observed winds on typical days with moderate or large pressure gradients, show that the pressure gradient is suddenly reduced, and the temperature gradient suddenly reversed, on entering the stratosphere. The temperature gradients calculated from the observed wind velocities were in good agreement with those deduced by Mr. W. H. Dines, from temperature and pressure observations.

In a written communication, Mr. W. H. Dines pointed out that the correct measurement of upper winds depended upon an assumed uniform rate of ascent of the balloons. He had found the pressure gradient to be zero at about twenty kilometres. Lt.-Col. Gold said that if the ascentional velocity of a balloon increased, the increase of wind velocity must appear greater when the one-theodolite method of observation was employed. He discussed the effect of temperature change in the troposphere and in the stratosphere. Mr. Whipple said that the fact that the strongest winds were at the border between the stratosphere and troposphere indicated that the biggest centrifugal force was at that level and provided machinery for sucking in air from above and below. The actual distribution of pressure and temperature in cyclones indicated that they were regions in which air was being sucked up from above. Mr. Richardson, Mr. J. S. Dines and Mr. J. E. Clark also spoke.

A paper by Capt. C. J. P. Cave was entitled "Quotations from the Diary of Samuel Pepys on the Weather." The author had collected together all references to the weather from the diary, using for this purpose Wheatley's edition. These amounted to 557 entries, and were arranged in chronological order. They formed a brief comment on the general weather conditions prevailing from January, 1660 to May 1669. In a preliminary essay the author summarized the principal weather events for each year. He pointed out that Pepys cannot claim to be considered as a meteorologist, and that his references to the weather are such as any one might make in writing a diary or in correspondence. Pepys's memory for meteorological events was not always good, and his remarks on the worst or best weather he remembers must be taken with caution.

Sir Henry Lambert, exhibited a manuscript weather diary kept by his great grandfather, Daniel Lambert, in the years 1781-82. He believed the observations were made on Tower Hill, and arranged that a copy might be made and preserved in the library.

The following candidates were balloted for and elected Fellows of the Society :—Mr. N. C. Ahluwalia, Mr. F. W. Baker, Mr. G. A. Clarke, Lieut. W. M. Cooke, R.N.R., Mr. P. de Rome, Mr. V. A. Jarvis-Clark, Mr. E. M. Maurice, Capt. L. F. Plugge, R.A.F., Capt. H. H. M. Spink, Mr. G. Thomson, Jun., Mr. R. G. Veryard, Lieut. D. C. Way, R.N.R., and Mr. P. R. Zealley.

SCOTTISH METEOROLOGICAL SOCIETY.

THE Annual Business Meeting of the Scottish Meteorological Society was held in the Society's Rooms, Edinburgh, on 19th December, 1919, Dr. C. G. Knott, President, in the Chair.

The Report from the Council referred to the working arrangements made with the Meteorological Committee in 1913; to the necessity of securing an adequate skeleton system of climatological stations under some public control which should guarantee continuity and efficiency; and to the loss sustained by the deaths of Mr. J. Mackay Bernard and Dr. John Aitken. There had been a slight increase in the membership list during the past year.

The Council had decided to regard the meeting held towards the end of each year as a purely business meeting for consideration of the Annual Reports and the election of Office-Bearers and Council. It was proposed, however, to hold a series of meetings, mainly in Edinburgh, at which lectures on popular lines will be given, or discussions opened, on questions of meteorological interest. The first of these lectures had indeed already been given in Glasgow by Captain Franklin, who opened the winter session of the Royal Philosophical Society of Glasgow by an address on "The Study of Meteorology in Schools and Universities." Other lectures were to be delivered in Edinburgh after Christmas.

The following Council and Office-Bearers were elected for the ensuing twelve months:—*President:* Dr. C. G. Knott; *Vice-Presidents:* Prof. T. Hudson Beare, and Mr. D. A. Stevenson; *Honorary Secretary:* Dr. E. M. Wedderburn, W.S.; *Honorary Treasurer:* Mr. W. B. Wilson, W.S.; *Council:* Mr. S. B. Hog, Mr. G. Thomson, Dr. A. Crichton Mitchell, Mr. G. A. Mitchell, Mr. M. M'Callum Fairgrieve, Prof. R. A. Sampson, F.R.S., Captain T. Bedford Franklin, Sir R. B. Greig, LL.D. and Mr. T. S. Muir.

REVIEWS.

Nedbφriagttagelser i Norge. Aargang xxiv., 1918. Christiania, 1919. Size, 14½ × 11. Pp. xii. + 123. One chart and 11 figures in text. Price, 6·00 kr.

WE should be lacking in the ordinary attributes of humanity if we were able to conceal a gleam of satisfaction that the magnificent Norwegian Rainfall Annual has at last dropped behind *British Rainfall* in the race for prompt publication in which it has so frequently carried off the palm. Glancing at the large mass of orderly statistics which it embodies, and bearing in mind the difficulties which surround the study of rainfall in a country like Norway, we can only wonder at the fact that its appearance is not more often delayed.

We note with interest the use of a novel form of rain gauge glass which overcomes the difficulty of accurately measuring small quantities, by means of a cone-shaped glass bottom with the apex upwards, the inverse of the device used in the "Camden" glass familiar in this country. It is probable that the meniscus difficulty is minimised in this way. The climatic peculiarities of the country make necessary the wide use of the Nipher shield for the prevention of loss by eddying, a hint which might well be taken to heart in some of the more exposed districts in the British Isles.

A finely reproduced rainfall map, on the scale of about twenty miles to an inch, present the year's records in a cartographical form. The distribution is highly orographical and presents many points of similarity to that in the West Highlands. The amounts recorded are, however, greatly inferior to those on our own western mountain barriers, rising only very locally above 2,000 mm. (79 inches), and falling to one-tenth of that amount at one or two places within the Arctic Circle. C.S.

Journal of the Scottish Meteorological Society. Vol. xviii. Third Series, No. xxxvi., 1918. Size, 11 × 7. Pp. 121. One plate. Price, 12s. 6d.

THE appearance of the Journal of the Scottish Meteorological Society is always welcome, and our own editorial struggles with adverse circumstances lead us readily to condone its somewhat tardy publication. The volume, for although issued between paper covers it attains that dignity, contains interesting and suggestive articles on some of the most recent developments of meteorological work.

Lt.-Col. E. Gold, F.R.S., betrays a wealth of knowledge and experience in his treatment of the relation between meteorology and aviation, especially in respect of accurate short-period forecasts.

Capt. T. B. Franklin contributes an instructive article on Meteorology and Agriculture; and C. K. M. Douglas an interesting paper on Optical Phenomena and the Composition of Clouds, a subject on which his keen meteorological instinct and exceptional opportunities for observation render his views peculiarly valuable. A fourth article by E. M. Wedderburn on Meteorology and Gunnery sets down some of the applications of meteorology to ballistics, which became of great importance during the war.

The usual statistical tables dealing with the Climatology of Scotland are given, including complete monthly rainfall records for 730 stations. It may perhaps be mentioned it has been the custom for many years past for these rainfall tables to be compared in detail with those sent to the British Rainfall Organization in order to eliminate errors and provide a means for the exchange of records received by only one of the two bodies. C.S.

A Continuous Record of Atmospheric Nucleation. By Carl Barus. Smithsonian Inst., Washington, 1905. Size, $9\frac{1}{4} \times 12\frac{1}{2}$. Pp. 226.

In this memoir Prof. Barus discusses the phenomenon which he entitles "Atmospheric Nucleation," and continues the researches described under "Experiments with Ionized Air" and "Structure of the Nucleus" in the Smithsonian Contributions to Knowledge, volume xxix., 1901 and 1903. The present volume consists of 226 large quarto pages, and describes only a part of the research which the author stated was being further continued. It is necessary for an intelligent appreciation of the work to refer to the preceding publications.

Professor Barus describes the nucleus as "at the outset simply a dust particle, small enough to float in the air, but much larger than the order of molecular size." He considers it one of the main features in bringing about the condensation of water from the atmosphere. Such nuclei, he states, are formed by agitating liquids such as by jets inpinging on obstacles and by combustion, *i.e.*, smokeless combustion. In addition to the mechanical, thermal, and chemical processes, he says high potential is a fruitful source of nuclei, such as a body highly charged with electricity. Also certain radiations, as ultra-violet light, x-rays, and radio-active bodies generate nuclei in air through which the radiation passes.

By the term nucleation is meant the number of such nuclei per cubic centimetre. Professor Barus holds that the nucleus is distinct from the ion, but that ionization is always accompanied by nucleation; he thinks nucleation owes its origin to the expulsion or absorption of the corpuscles representing the concomitant ionization. It is not very clear how under these circumstances the nucleus can exceed molecular dimensions as stated above.

The method of measuring nucleation and size of particles by the colour and diameter of "coronas" is used; the corona is observed when a beam of light is transmitted through the nucleated gas, and is a diffraction phenomenon more fully described in "the Structure of the Nucleus" above referred to.

The greater part of the volume is taken up with descriptions of apparatus and experiments. In chapter 7 a method is developed for the measurement of fog particles by means of the microscope. Chapter 9 is, perhaps, of the greatest interest to meteorologists, as it gives a record of over two years' observations of atmospheric nucleation in the City of Providence. It is shown that the maximum and minimum nucleation occurs at about the winter and summer solstices respectively. Much of the nucleation is attributed to combustion, and it is shown that generally speaking the cold weather causes a rise of nucleation, while rain or snow produces a fall; although snow, if dry, may even cause an increase. Tables and graphs of these results are given, and the graph showing the monthly nucleation for 1902 to 1904 shows the remarkable maximum

which occurs about the middle of December, and a less well defined minimum about July.

The work is a useful record of experiments bearing on condensation apart from the particular explanations suggested as accounting best for the phenomena observed. J. S. OWENS.

THE ATLANTIC TYPE OF DECEMBER WEATHER.

By L. C. W. Bonacina.

In England the depth of winter may manifest itself either by intense cold—the Arctic type, or by excessive damp—the Atlantic type. The latter type, the more common yet styled "unseasonable," is connected with the fact that the Atlantic Ocean is ceaselessly throwing off large quantities of vapour at a temperature much too high for the latitude belt between 50 and 60° N., and in the gloomy, damp heat from the stormy ocean, which characterizes it one simply sees the winter season in a dark garb instead of the more conventional white one. In this latitude warmth in winter almost invariably means weather of a severely rough and wet description, and the usual designation of such weather as "mild" in relation to the temperature only, is to put it mildly, rather unfortunate. This year the hard frost of early November gave place soon after the middle of the month to this other form of winter, which continued right through December. On many nights during the latter part of November and December, the deep roar of the great Atlantic gales—the true voice of the English winter—was very impressive. Heavy cyclonic gales are as much a climatic feature of midwinter as violent thunderstorms are of midsummer, and they are just as inspiring to the imagination. The close of December, 1919, was conspicuous for incessant rain, the intervals between the different quick-travelling bad weather systems being very brief and uncertain. A raw murky-looking morning with a touch of frost would be the sure precursor of another downpour by evening. To pedestrians and lovers of the open air excessive winter wet in place of invigorating frost and snow is very trying on account of the continual changing and drying of clothes which their outdoor habits render necessary. But the Atlantic type of weather brings its compensations in the form of a pure sweep of S.W. wind from the ocean, and in the soft transparency of the atmosphere during the finer intervals. Moreover, in open weather the forms of the forest trees loom out with a blackness and vividness as the branches sway in the gale, that is missing in the thicker atmosphere that prevails when the countryside is frost-bound and deep under snow.

METEOROLOGICAL NEWS AND NOTES.

MR. M. DE CARLE S. SALTER delivered a lecture entitled "Rainfall considered as a Geographical Function," at the meeting of the Geographical Association, at the London Day Training College, January 10th.

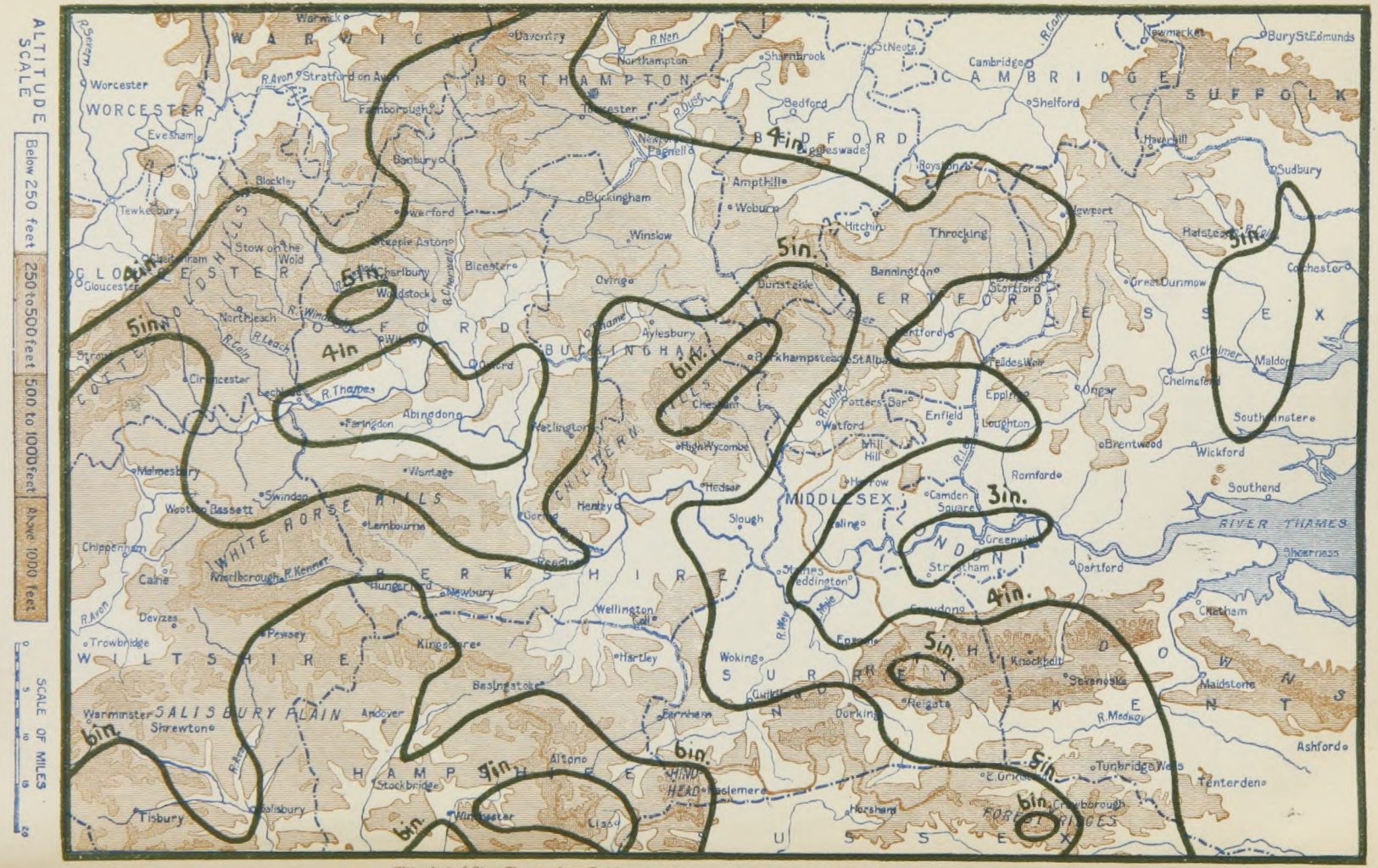
METEOROLOGICAL OFFICE RETIREMENTS:—The following members of the Staff of the Meteorological Office retired on December 31st, 1919 :—

		Period of Service.
Mr. F. J. Brodie	..	April, 1869—Dec. 1919.
Mr. W. G. James	..	May, 1869— 1875.
		and Mar. 1879—Dec., 1919.
Mr. J. Sheerman	..	Feb., 1882—Dec., 1919.
Mr. R. F. Wallace	..	Feb., 1883—Dec., 1919.

Mr. Frederick J. Brodie has been a frequent contributor to the pages of this magazine and has been for many years past the author of the regular articles on the "Weather of the Month," which replaced the "Meteorological Notes on the Month" by substituting a connected narrative for the fragmentary remarks of the Observers. For this task his professional experience rendered him peculiarly fitted. He was for a very long time the Meteorological correspondent of *The Times*. Mr Brodie is one of the small group of senior members of the staff of the Meteorological Office whose term of service extended back to the administration of Admiral Fitzroy, having begun his work more than half a century ago. We wish him many years of peaceful life in retirement.

WEATHER CONTROLS over the fighting during the summer of 1918 are discussed by Prof. R. De C. Ward, in an interesting paper in the *Scientific Monthly*, for October, 1918. Instances are quoted of of the great effects produced in military operations in France by decreased mobility of the armies after heavy rain; and of the advantages gained by attacks in fogs (especially at night), in thunder storms which drowned the noise of barrage fire and of favourable winds in gas attacks. On the Austro-Italian front particular mention is made of the flooding of the Piave, leading to shortage of Austrian supplies and consequent defeat from Montello to the sea. Of the other fronts, Mesopotamia occupies the author's special attention, as climate is there "the first thing to be taken into consideration in every move that is made." The meteorological feature of the desert, the mirage, has curiously to be included since in the early days of the campaign the Turks apparently saw the British supply and ambulance train "magnified and multiplied by the deceptive desert atmosphere," and fled. Food supply as a factor of military importance renders necessary the discussion of the influence of climate on crops in enemy countries.

THAMES VALLEY RAINFALL DECEMBER, 1919.



Symons's Meteorological Magazine

Watershed of River Thames above Teddington, and River Lee above Feildes Weir.

Isohyetals

THE WEATHER OF DECEMBER.

An abnormally cold November gave place to a period in which winds from some westerly quarter (from between S.W. and N.W.) were largely in evidence. As regards temperature the contrast between the two months was therefore very striking. In November midday shade readings of 50° and upwards were rare; in December they were of common experience, the highest being reported over England on the 2nd or 3rd, and at some of the Irish stations on the 4th or 5th. In each case the thermometer rose to 55° in several places, and at Worksop on the 3rd it touched 56°. The months was, however, not uniformly mild. Between the 8th and 10th, when a ridge of high barometric pressure passed eastwards across the United Kingdom, sharp frost was experienced in most districts, the sheltered thermometer falling on the night of the 8th or 9th to 25° or less in many parts of Great Britain, to 22° at Rothamsted and Geldeston, near Beccles, and to 20° at Balmoral. On the surface of the grass the minimum readings at this time were as low as 12° at Greenwich, 14° at Wisley and 15° at Tunbridge Wells. Another rather sharp frost occurred on the night of the 16th, and a far sharper one in Scotland on Christmas night. On the latter occasion the sheltered thermometer fell to 16° at West Linton (Perthshire) and 14° at Balmoral and Eskdalemiur; while on the surface of the grass it sank to 14° at Crathes, 12° at Balmoral and 10° at West Linton.

The mild weather which was so general at other times was due to oceanic winds blowing around deep cyclonic systems whose central areas travelled eastward across Iceland, or between Iceland and our own northern coasts. The passage of these disturbances was accompanied in most instances by heavy falls of rain, and in many cases by a serious increase in the strength of the wind. On the 2nd, when a secondary line-squall passed across England, the wind over our southern counties, rose, in gusts, to a velocity of 68 miles an hour at Kew, Brighton and Plymouth, 72 miles at Shoeburyness and 74 miles at Pendennis Castle (Falmouth). On the 18th or 19th, when a similar movement in pressure took place, the more northern districts were chiefly affected, the westerly to north-westerly gusts reaching a velocity of 70 miles an hour at Paisley and Alnwick Castle, and 78 miles at Southport. In not a few instances the sudden shift of wind from S.W. to N.W. was accompanied by thunder and lightning. At Kew a short by sharp thunderstorm was experienced on the 4th and again on the 6th, the occurrence of two such phenomena in December being without precedent in the records of the past 40 years.

In spite of the changeability of the weather the total duration of bright sunshine at some of the western stations was appreciably in excess of the average.

The rainfall of the month was above the average, practically everywhere, in one or two places reaching twice the average. Less than 4 inches was confined to small areas in the south Midlands, and parts of the east of Great Britain, and in Ireland only to a small strip round Dublin. More than 6 inches fell over considerable areas in the south of England, in the north-east of Scotland and Ireland, and practically everywhere in the west. More than 10 inches occurred over wide areas of the uplands. The general rainfall expresssed as a percentage of the average was as follows:—England and Wales, 155; Scotland, 130; Ireland, 156, and British Isles, 147.

In London (Camden Square) the month was unusually showery and mild. Rain fell on all but 5 days, and a rain spell lasted from the 13th to 31st. Mean temperature, 42°·7, or 3°·0 above the average. Duration of rainfall, 75·4 hours. Evaporation, ·06 inch.

RAINFALL TABLE FOR DECEMBER, 1919.

STATION.	COUNTY.	RAINFALL. Aver. 1875—1909. in.	1919. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days
Camden Square	*London*	2·13	3·47	+1·34	163	·85	1	27
Tenterden	*Kent*	2·77	3·38	+ ·61	122	·51	1	26
Arundel (Patching)	*Sussex*	2·91	6·08	+3·17	209	1·20	15	23
Fordingbridge (Oaklands)	*Hampshire*	3·35	6·14	+2·79	183	1·20	1	28
Oxford (Magdalen College)	*Oxfordshire*	2·06	3·82	+1·76	185	1·04	1	25
Wellingborough	*Northampn*	2·13	3·33	+1·20	156	·58	1	23
Bury St. Edmunds (Westley)	*Suffolk*	2·14	4·31	+2·17	201	·71	1	23
Geldeston [Beccles]	*Norfolk*	2·07	3·49	+1·42	169	·41	7	24
Polapit Tamar [Launceston]	*Devon*	4·46	7·83	+3·37	176	1·14	1	29
Rousdon [Lyme Regis]	,,	3·68	5·04	+1·36	137	·83	1	27
Ross (Birchlea)	*Herefordshr.*	2·71	3·28	+ ·57	121	·48	1	28
Church Stretton (Wolstaston)	*Shropshire*	2·99	4·69	+1·70	157	·52	1	23
Boston	*Lincoln*	1·88	3·75	+1·87	200	·63	1	28
Worksop (Hodsock Priory)	*Nottingham*	2·17	3·35	+1·18	154	·76	15	20
Mickleover Manor	*Derbyshire*	2·38	4·17	+1·79	175	·80	22	24
Congleton (Buglawton Vic.)	*Cheshire*	2·89	4·67	+1·78	162	·64	22	28
Southport (Hesketh Park)	*Lancashire*	3·10	4·39	+1·29	142	·90	22	25
Wetherby (Ribston Hall)	*York, W.R.*	2·27	3·85	+1·58	170	·65	26	14
Hull (Pearson Park)	,, *E.R.*	2·32	3·50	+1·18	151	·50	26	26
Newcastle (Town Moor)	*North'land*	2·46	3·01	+ ·55	122	·64	15	22
Borrowdale (Seathwaite)	*Cumberland*	15·14	16·85	+1·71	111	...	...	...
Cardiff (Ely)	*Glamorgan*	4·70	8·64	+3·94	184	·88	1	29
Haverfordwest	*Pembroke*	5·18	8·51	+3·33	164	1·36	10	30
Aberystwyth (Gogerddan)	*Cardigan*	4·66	...	...	...	...	...	...
Llandudno	*Carnarvon*	2·84	5·73	+2·89	202	1·17	22	25
Cargen [Dumfries]	*Kirkcudbrt.*	4·84	7·77	+2·93	161	1·00	10	26
Marchmont House	*Berwick*	2·83	4·24	+1·41	150	·93	15	20
Girvan (Pinmore)	*Ayr*	5·48	10·48	+5·00	191	1·96	10	26
Glasgow (Queen's Park)	*Renfrew*	3·95	5·83	+1·88	148	·58	30	27
Islay (Eallabus)	*Argyll*	5·73	7·85	+2·12	137	·88	26	29
Mull (Quinish)	,,	6·59	7·72	+1·13	117	·76	1	29
Loch Dhu	*Perth*	9·48	14·35	+4·87	151	1·90	10	28
Dundee (Eastern Necropolis)	*Forfar*	2·67	4·18	+1·51	157	·94	30	23
Braemar	*Aberdeen*	3·13	6·06	+2·93	194	·90	22	22
Aberdeen (Cranford)	,,	3·43	5·91	+2·48	172	1·55	15	22
Gordon Castle	*Moray*	2·72	2·28	— ·44	84	...	...	...
Drumnadrochit	*Inverness*	3·76	3·51	— ·25	93	·60	21	19
Fort William	,,	9·41	7·96	—1·45	85	·70	5	27
Loch Torridon (Bendamph)	*Ross*	9·71	7·98	—1·73	82	·91	26	24
Dunrobin Castle	*Sutherland*	3·09	3·85	+ ·76	125	·55	24	16
Glanmire (Lota Lodge)	*Cork*	5·29	4·97	— ·32	94	·60	10	28
Killarney (District Asylum)	*Kerry*	6·92	7·16	+ ·24	103	·85	30	29
Waterford (Brook Lodge)	*Waterford*	4·32	5·95	+1·63	138	1·14	10	28
Nenagh (Castle Lough)	*Tipperary*	4·34	6·47	+2·13	149	·68	10	29
Ennistymon House	*Clare*	5·03	7·52	+2·49	149	·79	30	31
Gorey (Courtown House)	*Wexford*	3·42	5·13	+1·71	150	1·35	10	24
Abbey Leix (Blandsfort)	*Queen's Co.*	3·41	5·84	+2·43	171	1·11	10	29
Dublin (Fitz William Square)	*Dublin*	2·27	3·48	+1·21	153	·60	14	24
Mullingar (Belvedere)	*Westmeath*	3·39	6·05	+2·66	178	·74	11	28
Crossmolina (Enniscoe)	*Mayo*	6·11	10·26	+4·15	168	1·21	30	31
Cong (The Glebe)	,,	5·42	8·30	+2·88	153	1·43	29	29
Collooney (Markree Obsy.)	*Sligo*	4·34	7·78	+3·44	179	·93	30	31
Seaforde	*Down*	3·77	8·21	+4·44	218	1·36	22	24
Ballymena (Harryville)	*Antrim*	3·97	6·60	+2·63	166	·98	22	30
Omagh (Edenfel)	*Tyrone*	3·91	9·14	+5·23	234	1·46	22	31

SUPPLEMENTARY RAINFALL, DECEMBER, 1919.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches
II.	Sevenoaks, Speldhurst Close.	4·52	XI.	Lligwy	5·41
,,	Ramsgate	2·74	,,	Douglas, Isle of Man	7·25
,,	Hailsham	5·00	XII.	Stoneykirk, Ardwell House...	6·89
,,	Totland Bay, Aston House...	5·58	,,	Carsphairn, Shiel	15·76
,,	Stockbridge, Ashley	6·26	,,	Langholm, Drove Road	8·27
,,	Grayshott	6·50	XIII.	Selkirk	4·10
,,	Ufton Nervet	5·57	,,	North Berwick Reservoir	2·85
III.	Harrow Weald, Hill House...	4·34	,,	Edinburgh, Royal Observaty.	3·14
,,	Pitsford, Sedgebrook	3·96	XIV.	Biggar	5·80
,,	Woburn, Milton Bryant	4·40	,,	Maybole, Knockdon Farm ...	7·52
,,	Chatteris, The Priory	3·65	XV.	Shiskine	11·17
IV.	Elsenham, Gaunts End	3·79	,,	Ardgour House	9·86
,,	Rayleigh	2·28	,,	Oban	...
,,	Colchester, Hill Ho., Lexden	3·32	,,	Holy Loch, Ardnadam	13·68
,,	Aylsham, Rippon Hall	4·61	,,	Loch Venachar	10·65
,,	Swaffham	4·59	XVI.	Glenquey	7·00
V.	Bishops Cannings	5·25	,,	Loch Rannoch, Dall	7·09
,,	Weymouth	4·74	,,	Aberfeldy, Dunros	5·93
,,	Ashburton, Druid House	10·18	,,	Coupar Angus	4·83
,,	Cullompton	6·55	,,	Montrose, Sunnyside Asylum.	4·80
,,	Lynmouth, Rock House	7·69	XVII.	Balmoral	4·08
,,	Mortonhampstead	6·59	,,	Fyvie Castle	3·50
,,	Hartland Abbey	6·10	,,	Keith Station	3·58
,,	St. Austell, Trevarna	8·02	XVIII.	Rothiemurchus	3·54
,,	North Cadbury Rectory	5·52	,,	Loch Quoich, Loan	19·60
VI.	Ledbury, Underdown	3·41	,,	Skye, Dunvegan	10·54
,,	Clifton, Bishop's Stoke	5·99	,,	Fortrose	2·23
,,	Shifnal, Hatton Grange	3·47	,,	Glencarron Lodge	8·40
,,	Droitwich	3·38	XIX.	Tongue Manse	3·98
,,	Blockley, Upton Wold	4·01	,,	Melvich	3·87
VII.	Grantham, Saltersford	3·33	,,	Loch More, Achfary	7·19
,,	Louth, Westgate	3·21	XX.	Dunmanway, The Rectory	10·10
,,	Mansfield, West Bank	4·19	,,	Mitchelstown Castle	5·53
,,	Derby, Midland Railway	3·68	,,	Gearahameen	14·90
VIII.	Nantwich, Dorfold Hall	5·12	,,	Darrynane Abbey	7·34
,,	Bolton, Queen's Park	7·83	,,	Clonmel, Bruce Villa	4·00
,,	Lancaster, Strathspey	5·89	,,	Roscrea, Timoney Park	5·54
IX.	Wath-upon-Dearne	2·89	,,	Broadford, Hurdlestown	6·87
,,	West Witton	4·15	XXI.	Enniscorthy, Monksgrange..	7·60
,,	Scarborough, Scalby	3·49	,,	Rathnew, Clonmannon	5·06
,,	Ingleby Greenhow	4·17	,,	Hacketstown Rectory	7·06
,,	Mickleton	4·20	,,	Ballycumber, Moorock Lodge	5·78
X.	Bellingham, High Green Manor	4·86	,,	Balbriggan, Ardgillan	5·21
,,	Ilderton, Lilburn Cottage	4·35	,,	Castle Forbes Gardens	6·08
,,	Keswick, The Bank	8·69	XXII.	Ballynahinch Castle	9·05
,,	Orton	8·29	,,	Woodlawn	5.08
XI.	Llanfrechfa Grange	7·40	,,	Westport House	7·81
,,	Treherbert, Tyn-y-waun	18·73	,,	Blacksod Point	9·15
,,	Carmarthen, The Friary	7·54	XXIII.	Enniskillen, Portora	7·54
,,	Fishguard, Goodwick Station.	6·64	,,	Dartrey [Cootehill]	7·25
,,	Crickhowell, Tal-y-maes	5·50	,,	Warrenpoint, Manor House	7.41
,,	Birmingham WW., Tyrmynydd	12·27	,,	Belfast, Cave Hill Road	7·45
,,	Lake Vyrnwy	10·90	,,	Glenarm Castle	6·66
,,	Llangynhafal, Plas Dràw	5·09	,,	Londonderry, Creggan Res...	7·03
,,	Rhiwbryfdir	17·23	,,	Milford Manse	8·03
,,	Dolgelly, Bryntirion	13·50	,,	Killybegs	10·93

ERRATUM.—November, 1919, at Swaffam, *for* 2·61 *read* 1·88.

Climatological Table for the British Empire, July, 1919.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain Depth.	Total Rain Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	82·3	11	43·2	9	68·9	51·5	51·0	75	127·8	42·2	1·75	14	7·6
Malta	103·6	13	67·0	17*	84·4	20·9	...	73	153·0	...	·00	0	2·5
Lagos	89·0	8	69·2	21	81·6	73·1	72·4	83	161·4	57·5	·86	6	7·6
Cape Town	69·8	28	34·1	[illegible]	60·8	45·3	46·8	79	...	...	3·80	13	5·2
Johannesburg	68·2	1	34·1	19	62·7	42·6	37·2	69	...	...	·05	2	2·6
Mauritius	76·6	14	57·2	23	74·1	61·5	58·1	73	..	49·8	2·55	27	6·5
Bloemfontein	70·4	1, 2	20·5	15	63·9	32·6	31·1	65	...	...	·39	3	1·1
Calcutta...	94·4	29	75·5	12	88·6	79·1	78·0	87	...	74·1	11·99	15	9·1
Bombay	87·9	17	75·4	2	85·4	78·4	76·9	85	134·2	72·2	24·49	30	7·9
Madras	102·2	3	73·5	11	94·3	78·2	72·8	73	154·3	72·9	6·16	12	6·3
Colombo, Ceylon ...	88·4	18	73·7	28	85·3	76·7	73·4	80	156·9	70·8	4·26	23	8·2
Hongkong	90·8	3	73·5	4	86·4	78·3	75·4	81	...	...	19·43	13	6·9
Sydney	74·0	21	38·5	16	63·6	45·7	41·7	68	120·3	38·6	2·02	7	3·5
Melbourne	61·9	25	31·0	17	55·3	42·0	39·4	68	107·6	22·0	2·34	19	6·3
Adelaide	68·6	24	36·8	27	60·3	44·5	43·5	70	125·2	25·2	1·39	15	5·7
Perth	74·1	17	40·5	12	65·5	50·9	49·9	77	131·7	32·4	2·76	19	6·0
Coolgardie	79·8	18	34·8	12	66·0	45·7	43·2	60	136·2	34·6	1·38	5	4·4
Brisbane	78·0	30	40·6	5	69·6	49·7	46·2	59	128·1	30·8	·18	4	2·9
Hobart, Tasmania ..	60·6	25	33·8	14	52·1	39·5	37·0	68	111·2	26·4	2·20	14	5·1
Wellington	57·7	13	32·0	8	53·4	42·3	42·2	81	107·0	...	3·05	18	6·9
Jamaica, Kingston ..	95·2	27	71·8	15	90·6	74·0	72·2	77	...	...	·60	5	4·5
Grenada	87·0	17	72·0	4	85·0	75·0	...	78	137·0	...	8·09	24	4·0
Toronto	98·0	4	52·0	11	84·9	61·6	58·6	67	134·9	48·4	3·20	7	3·8
Fredericton	92·5	5	46·5	9	78·4	54·7	58·0	72	...	...	3·22	9	5·5
St. John, N.B. ...	82·0	20	47·0	1	67·9	52·6	54·2	83	140·7	42·8	4·52	11	6·2
Victoria, B.C.	84·5	14	47·2	1	66·4	50·6	49·0	76	140·0	39·4	·02	1	2·3

* 19, 20.

Johannesburg.—Bright sunshine, 276·5 hours.

Mauritius.—Mean temp. 0°·5 below, dew point 1°·4 below, relative humidity 2·0 below, and R. ·06 in. above, respective averages.

COLOMBO, CEYLON.—Mean temp. 0°·1 below, dew point 0°·6 below, and R. 1·86 in. below, averages. Mean velocity of wind 5·3 miles per hour, prevailing direction W.S.W.

HONGKONG.—Bright sunshine, 241·4 hours. Mean velocity of wind 12·4 miles per hour, prevailing direction E.S.E. Mean temperature 81°·8.

Melbourne.—Mean temperature normal, R. ·52 in. below average.

Adelaide.—R. 1·26 in. below average.

Perth.—R. 0·47 in. above average.

Coolgardie.—R. ·40 in. above average.